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NUMERICAL NONLINEAR INELASTIC ANALYSIS OF STIFFENED SHELLS OF REVOLUTION

Volume IV - SATELLITE-1P Program for STARS-2P Digital Computer Program

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16. ABSTRACT

Volume IV of this report contains the user and programming information necessary for the application of the SATELLITE-1P program. The program function is data debugging for the STARS-2P (Plasticity) program.

This report is prepared in four volumes. The other volumes are:

Volume I — Theory Manual for STARS-2P Digital Computer Program
Volume II — User's Manual for STARS-2P Digital Computer Program
Volume III — Engineer's Program Manual for STARS-2P Digital Computer Program

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INTRODUCTION

The STARS-2P program performs a significant amount of calculations prior to the complete processing of all data. Thus data errors or inconsistencies usually cause a run to terminate after the first data error is encountered. To overcome the resulting problem of requiring several computer runs to debug data, a special data debugging package called SAT-1P was created.

The program was written exclusively in FORTRAN IV for the IBM 370-165 computer, and then converted to the UNIVAC 1108. The core utilization of the program is 32,000 words.

SECTION 1

SATELLITE-1P PROGRAM

1.1 INPUT: The sole purpose of the SAT-1P program is data debugging of the STARS-2P program input data deck. Therefore the input data is identical to that described for the STARS program (Ref. 1), with one exception to be discussed below. For this purpose the dash separator cards, which are actually required only for data separation in the SATELLITE program, are accepted also by the STARS program.

The one data change involves the first card of the data deck, which in the STARS program is an arbitrary alphanumeric card. For the SAT-1P program this card is:

I. Title Card	Column	Format
A. Alphameric title (submission description)	1-60	15A4
B. Scale Extent	61-70	F10.0

This number will be used as the scale extent in the graphics output of the SATELLITE program. For example if the input number is 3000., the scale for all the diagrams will be set (square scale is used) so that 3,000.0 fits properly on 8 in. paper. A "default" option to this input is also available. If no scale extent is input, the program will size each region topology diagram on a square scale to best fit that region, resulting in different scales for different regions.

All other input remains unchanged from the STARS-2P program.

1.2 OUTPUT: The SAT-1P program functions basically are the following:

A. Check all STARS-2P input data for consistency.

B. Check all STARS-2P input data for possibilities of causing "divide by zero" errors.

C. Check shell idealizations by providing exact plots of input points and/or shapes, and topology, thus allowing the user to locate gaps or other types of errors.

D. Check spellings on alphameric clues, and where possible, format errors. In the latter case, no attempt has been made to override systems automatic terminations due to format inconsistencies. However, the use of the dash separator cards often allows further checking to proceed. The dash separator cards also overcome user errors in setting input table lengths.

Many of the errors encountered in the STARS-2P data deck will not affect the idealization plotting capability of the SAT-1P program. In cases where plotting is affected, as much plotting as possible will be accomplished before termination. Additional error messages will be provided directly on the charts.

1.3 EXAMPLES, FLOW CHART, LISTING: The execution of one sample problem by the SAT-1P program is provided on the following pages. The data deck in this case is free of errors. For sample errors to be detected see the enclosed program listing or Reference 2.

SATELLITE-1P

STARS-2P (PLASTICITY) DATA DEBUGGING PROGRAM

VERSION DATA -- OCTOBER 1, 1973

FOR INFORMATION CALL V. SVALBONAS
(516) 575-7701
P. OGILVIE

```
  PLATE UNDER CYCLIC LOAD
 4  4 2   3   120  20 2          56     56
NLPL      1
ALUM        ISOT
   .0000000        .0000000        .0000000        .0000000        .0000000
   .0000000        .0000000        .0000000        .0000000        .0000000
   .1005000+08     .0000000        .0000000        .0000000        .0000000
   .0000000        .0000000        .0000000        .0000000        .0000000
   .3300000+00     .0000000        .0000000        .0000000        .0000000
   .0000000        .0000000        .0000000        .0000000        .0000000
   .0000000        .0000000        .0000000        .0000000        .0000000
   .0000000        .0000000        .0000000        .0000000        .0000000
   .8417000+04     .0000000        .0000000        .0000000        .0000000
   .0000000        .0000000        .0000000        .0000000        .0000000
   .3967000+01     .0000000        .0000000        .0000000        .0000000
   .0000000        .0000000        .0000000        .0000000        .0000000
   .4000000+04     .0000000        .0000000        .0000000        .0000000
   .0000000        .0000000        .0000000        .0000000        .0000000
ALUI        ISOT
   .0000000        .0000000        .0000000        .0000000        .0000000
   .0000000        .0000000        .0000000        .0000000        .0000000
   .1005000+08     .0000000        .0000000        .0000000        .0000000
   .0000000        .0000000        .0000000        .0000000        .0000000
   .3300000+00     .0000000        .0000000        .0000000        .0000000
   .0000000        .0000000        .0000000        .0000000        .0000000
   .0000000        .0000000        .0000000        .0000000        .0000000
   .0000000        .0000000        .0000000        .0000000        .0000000
   .8417000+04     .0000000        .0000000        .0000000        .0000000
   .0000000        .0000000        .0000000        .0000000        .0000000
   .3967000+01     .0000000        .0000000        .0000000        .0000000
   .0000000        .0000000        .0000000        .0000000        .0000000
   .4000000+09     .0000000        .0000000        .0000000        .0000000
   .0000000        .0000000        .0000000        .0000000        .0000000

 1 0 0  PLATE
    1    1    2
21 20
    .002          1.0      E-04  .0006                                    0.
 0.0
ISOT       ALUI        SING        THIC        NOTH        KINE                2
   .2000000-02     .2000000-01
   .2615000+00     .2615000+00
000100
   .1200000+05     .1200000+05
    1    1    2

 1 0 0  PLATE
    2    2    3
21 20
    .01780        1.0      E-04  .005933                                  0.
 0.0
```

```
ISOT       ALUM       SING       THIC       NOTH       KINE                    2
   .2000000-01   .1875000+00
   .2615000+00   .2615000+00
000100
   .1200000+05   .1200000+05
    1     1     2
-------------------------------------------------------------------------------

 1 0 0  PLATE
    3     3     4
21 20
   .21130        1.0       E-04   .042250                                   0.
 0.0
ISOT       ALUM       SING       THIC       NOTH       KINE                    2
   .1875000+00   .6100000+00
   .2615000+00   .2615000+00

    1     1     2
-------------------------------------------------------------------------------

 1 0 0  PLATE
    4     4     5
21 20
   1.0           1.0       E-04   .2                                        0.
 0.0
ISOT       ALUM       SING       THIC       NOTH       KINE                    2
   .6100000+00   .2610000+01
   .2615000+00   .2615000+00

    1     1     2
-------------------------------------------------------------------------------

    5     0     0
 1 0 1 0 0
 2 0 1 1 1
 3 0 1 1 1
 4 0 1 1 1
 5 0 0 1 1
-------------------------------------------------------------------------------

    1
    1     1   -.150797
-------------------------------------------------------------------------------

 4  4 2   3  -190   20    5 1
ALUM       ISOT
   .0000000      .0000000      .0000000      .0000000      .0000000
   .0000000      .0000000      .0000000      .0000000      .0000000
   .1005000+08   .0000000      .0000000      .0000000      .0000000
   .0000000      .0000000      .0000000      .0000000      .0000000
   .3300000+00   .0000000      .0000000      .0000000      .0000000
```

```
 .0000000      .0000000      .0000000      .0000000      .0000000
 .0000000      .0000000      .0000000      .0000000      .0000000
 .0000000      .0000000      .0000000      .0000000      .0000000
 .1683400+05   .0000000      .0000000      .0000000      .0000000
 .0000000      .0000000      .0000000      .0000000      .0000000
 .3967000+01   .0000000      .0000000      .0000000      .0000000
 .0000000      .0000000      .0000000      .0000000      .0000000
 .4000000+04   .0000000      .0000000      .0000000      .0000000
 .0000000      .0000000      .0000000      .0000000      .0000000
ALUI      ISOT
 .0000000      .0000000      .0000000      .0000000      .0000000
 .0000000      .0000000      .0000000      .0000000      .0000000
 .1005000+08   .0000000      .0000000      .0000000      .0000000
 .0000000      .0000000      .0000000      .0000000      .0000000
 .3300000+00   .0000000      .0000000      .0000000      .0000000
 .0000000      .0000000      .0000000      .0000000      .0000000
 .0000000      .0000000      .0000000      .0000000      .0000000
 .0000000      .0000000      .0000000      .0000000      .0000000
 .1683400+05   .0000000      .0000000      .0000000      .0000000
 .0000000      .0000000      .0000000      .0000000      .0000000
 .3967000+01   .0000000      .0000000      .0000000      .0000000
 .0000000      .0000000      .0000000      .0000000      .0000000
 .4000000+07   .0000000      .0000000      .0000000      .0000000
 .0000000      .0000000      .0000000      .0000000      .0000000
```

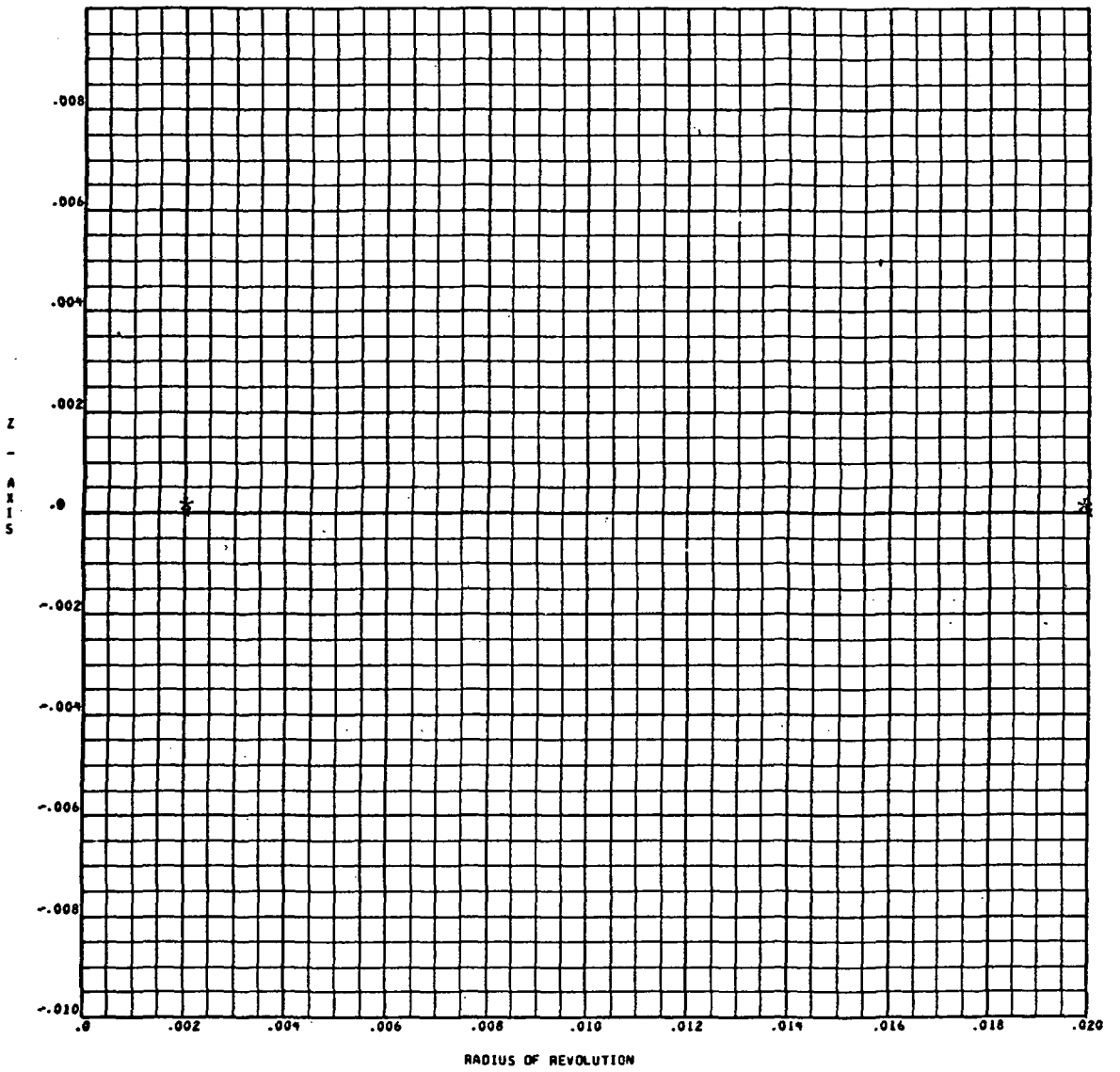
```
000100
   .1900000+05   .1900000+05
000100
   .1900000+05   .1900000+05
```

```
   1.    1   =.238762
```

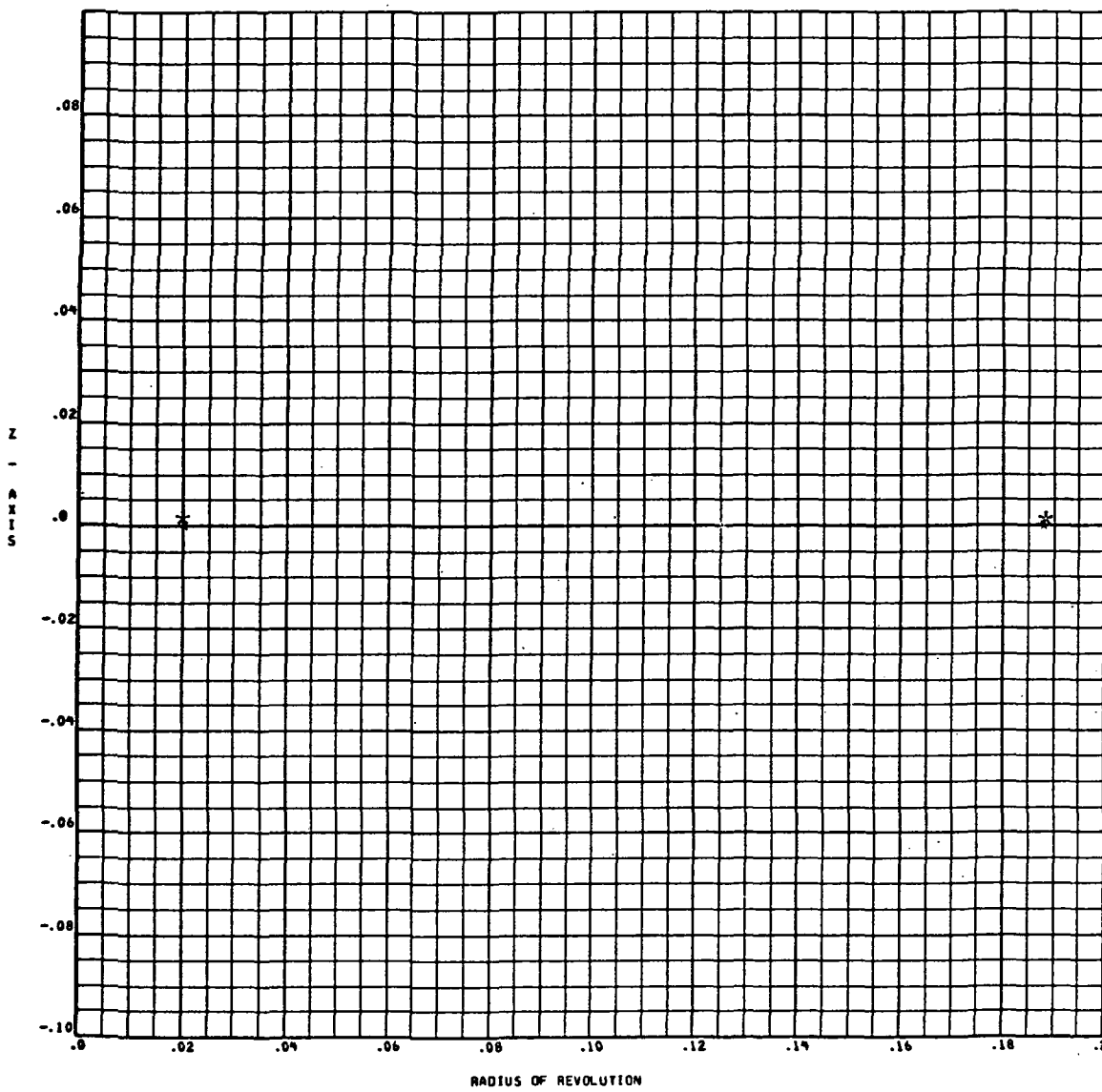
```
 4  4 2   3   190  20   0
```

```
NO DETECTABLE ERRORS FOUND.
```

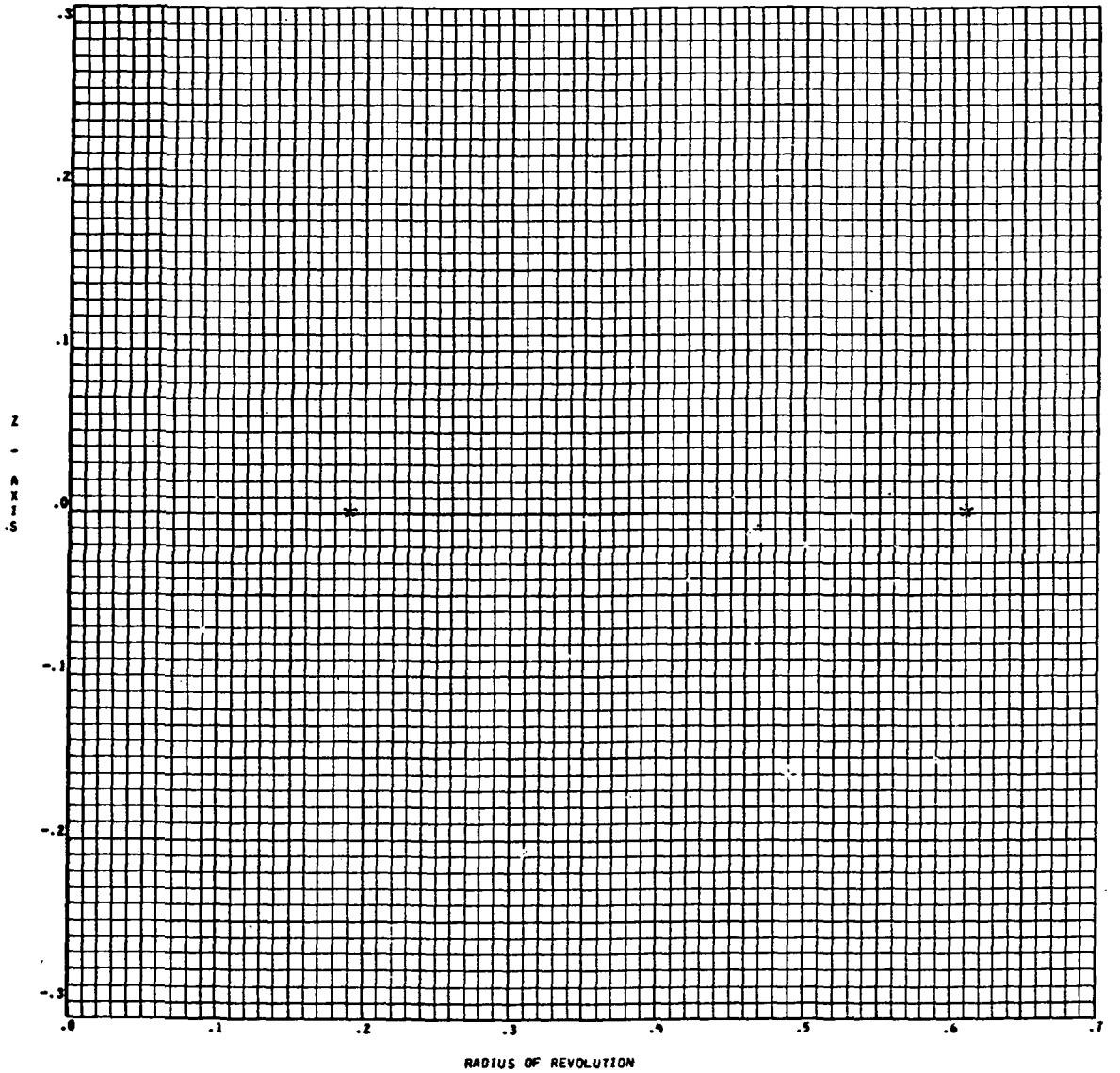
REGION NUMBER 1 1 SEGMENTS 0 LINKS

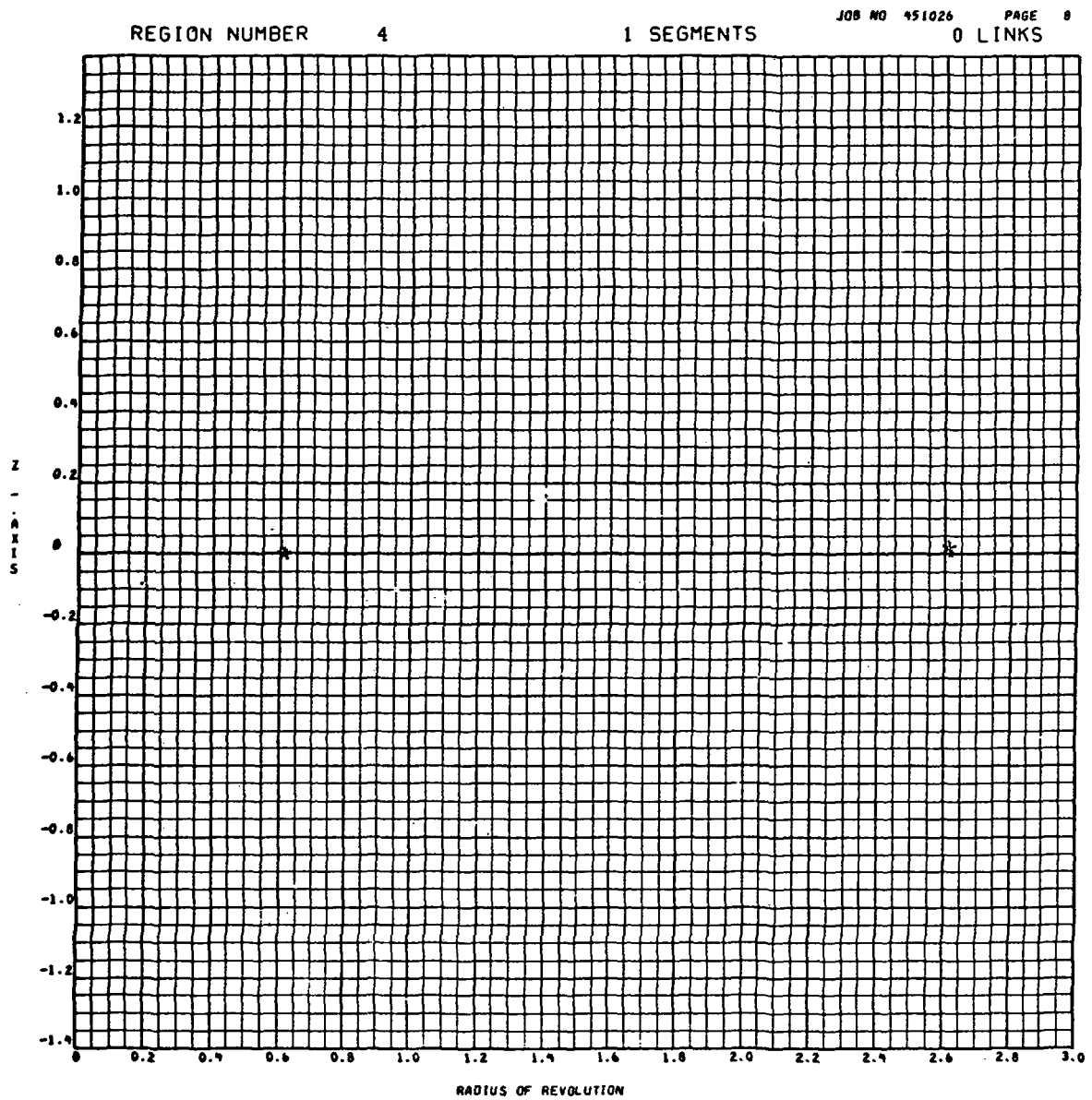


REGION NUMBER 2 1 SEGMENTS 0 LINKS

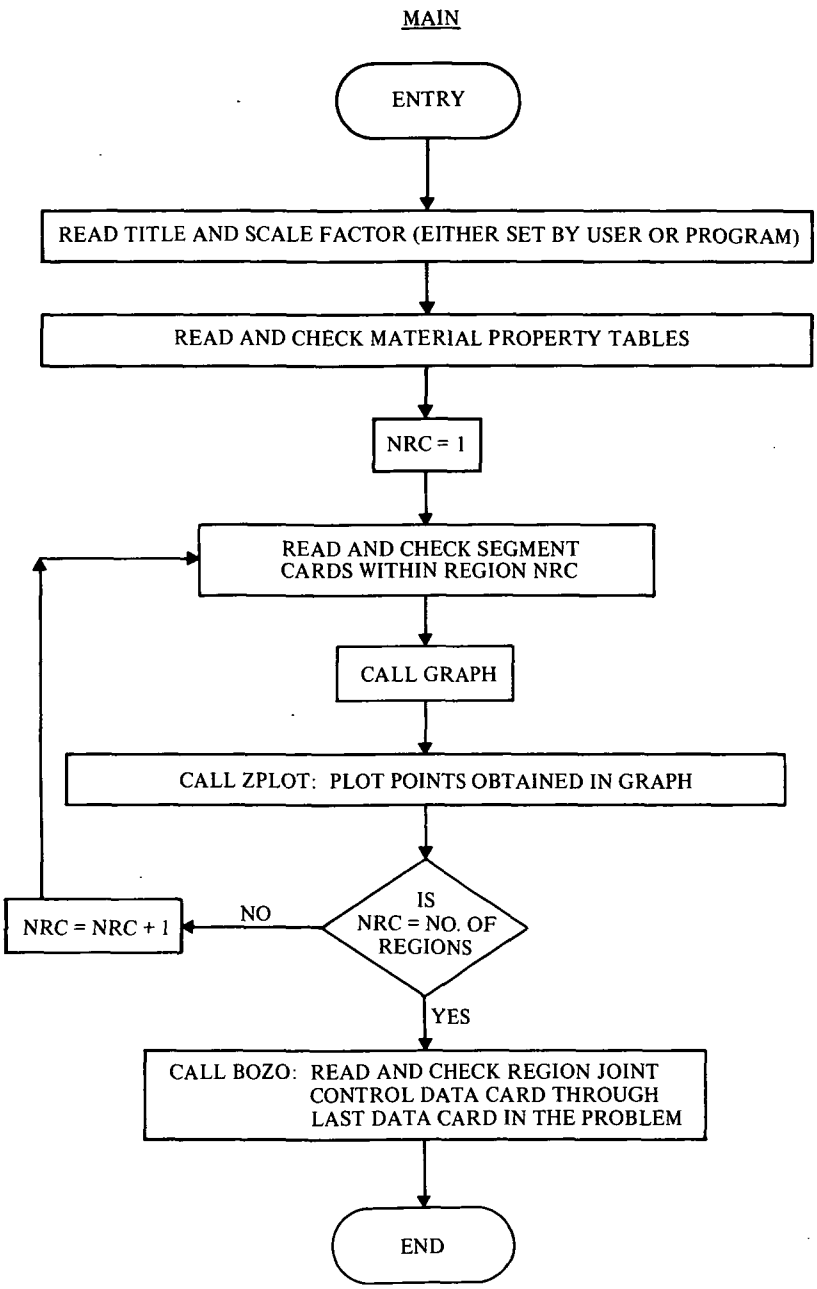


REGION NUMBER 3 1 SEGMENTS 0 LINKS

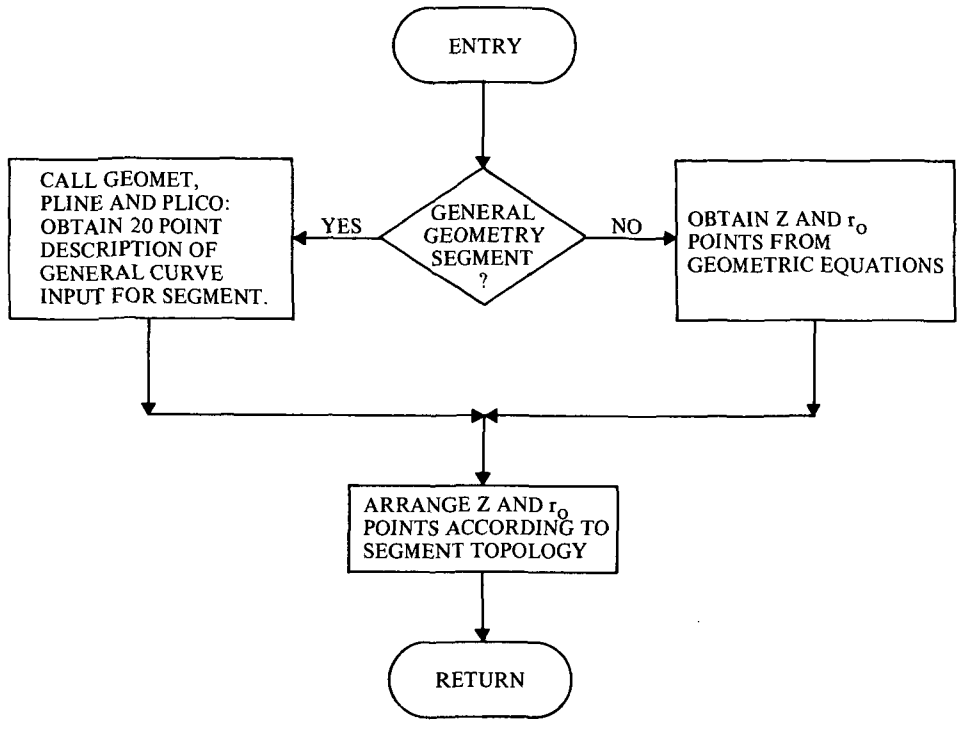



JOB NO 451026 PAGE 8
REGION NUMBER 4
1 SEGMENTS
0 LINKS
1.2
1.0
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1.0
-1.2
-1.4
Z - AXIS
0 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0 2.2 2.4 2.6 2.8 3.0
RADIUS OF REVOLUTION

The flow charts and listings of the SAT-1P program follow. The functions of the MAIN, GRAPH, ZPLOT and BOZO routines are explicit from the flow charts and need no further elaboration. The routines GEOMET, PLINE and PLICO are discussed in Reference 3.


MAIN
ENTRY
READ TITLE AND SCALE FACTOR (EITHER SET BY USER OR PROGRAM)
READ AND CHECK MATERIAL PROPERTY TABLES
NRC = 1
READ AND CHECK SEGMENT CARDS WITHIN REGION NRC
CALL GRAPH
CALL ZPLOT: PLOT POINTS OBTAINED IN GRAPH
IS NRC = NO. OF REGIONS
NO
NRC = NRC + 1
YES
CALL BOZO: READ AND CHECK REGION JOINT CONTROL DATA CARD THROUGH LAST DATA CARD IN THE PROBLEM
END

GRAPH


ENTRY
GENERAL GEOMETRY SEGMENT ?
YES
NO
CALL GEOMET, PLINE AND PLICO: OBTAIN 20 POINT DESCRIPTION OF GENERAL CURVE INPUT FOR SEGMENT.
OBTAIN Z AND r_o POINTS FROM GEOMETRIC EQUATIONS
ARRANGE Z AND r_o POINTS ACCORDING TO SEGMENT TOPOLOGY
RETURN

```
RUN,//T STARSS,1HNTSV440063,KEYJOHBIN214,3,500
ASG,T PUR,T,SAVE05
FREE TPF$.
ASG,T TPF$,F/1/POS/10
FOR,IS BLDATA,BLDATA
      BLOCK DATA                                                        100010
      COMMON /NAM1/ FACE(4),STRGO(7),THERM(4),MATER(3),SEGTAB(12)       100020
      DATA FACE/4HSING,4HEQUA,4HUNEQ,4HBLAN/                            100030
      DATA STRGO/11.0,13.0,21.0,31.0,12.0,14.0,15.0/                    100040
      DATA THERM/4HTHST,4HNOTH,4HTHCN,4HTHIN/                           100050
      DATA MATER/4HISOT,4HORTH,4HSTIF/                                  100060
      DATA SEGTAB/4HST10,4HTHIC,4HRWAF,4HRWA1,4HRWA2,4HRWA3,4HISG1,     100070
     1             4HISG2,4HISG3,4HST11,4HST12,4HST13/                  100080
      END                                                               100090
FOR,IS MAIN,MAIN
C                                                                       200010
C     ****************************************************************  200020
C     *                                                              *  200030
C     *                        SATELLITE-1P                          *
C     *                                                              *  200050
C     *                   DATA DEBUGGING PROGRAM                     *  200060
C     *                          FOR                                 *  200070
C     *                     STARS-2P (PLASTICITY)                    *
C     *                                                              *  200090
C     ****************************************************************  200100
C                                                                       200110
      INTEGER SAVJTC,SAVSTP,SEGTAB,THICK,TYPE                           200120
      INTEGER XN1,XN2,XN                                                200130
      COMMON /NAM1/ FACE(4),STRGO(7),THERM(4),MATER(3),SEGTAB(12)       200140
      COMMON/GRAPHS/STIC(30),STP(30),GG1(30),GG2(30),GG3(30),           200150
     1IREGC,ISEG ,NSEG,MGEOM(30),JLINK(30),ILINK(30),ANGLNK(30),NSKL    200160
     2JJT(30),IJT(30)                                                   200170
      COMMON /GPLOT/ ZZ(600),RRAD(600),NPT,NZR,DX                       200180
      COMMON /SPLINS/ ANG,PSI(100),RADR(100),ZI(14),RI(14),NRZIN,       200190
     1                POLY(10),NCOEF                                   200200
      COMMON /TYGER/ XMAT(270,10),LST(30),ST(30,31),DUM(20),NSEGS(30),
     C               NRNG(30),JROW(30,30),KELVN(30,30),JMAT(30,30),
     O               NPP(30,30),NXMAT(20),NREG,NORING,NMPT
      COMMON NERROR,ICOUNT                                              200210
      DIMENSION STD(10),DLP(4)
      DIMENSION XDUM(6),JCHK(30),LDEF(9)
      DIMENSION NRZN(30),ZJ(14,30),RJ(14,30)                            200250
      DIMENSION ANGL(30),WORD(3),HARD(3)
      EQUIVALENCE (DUM(1),D)                                            200270
      DATA DLIMTR/4H----/,A/1HA/,B/1HB/                                 200280
      DATA WORD/'PLAS','NLIN','NLPL'/
      DATA HARD/'ISOT','KINE','PERF'/
2000  FORMAT(20A4)                                                      200300
2001  FORMAT(1X,20A4)                                                   200310
      IREGC = 1                                                         200320
    1 READ(5,1999,END=555) DX,DUM                                       200330
1999  FORMAT(60X,F10.0,T1,20A4)                                         200340
      WRITE(6,1901)                                                     200350
1901  FORMAT(1H1,20(/),60X,12HSATELLITE-1P////45X,44HSTARS-2P (PLASTICIT
     1Y) DATA DEBUGGING PROGRAM////51X,31HVERSION DATA     OCTOBER 1, 197
     23,28(/),80X,35HFOR INFORMATION CALL   V. SVALBONAS/117X,14H(516) 5
     375-7701/103X,10HP. OGILVIE)                                       200390
      WRITE(6,1726)                                                     200400
1726  FORMAT(1H1)                                                       200410
      NIX = 0                                                           200420
      ICOUNT = 0                                                        200430
```

```
      ICT = 1
      NPROB = 1
      DX = DX/8.0                                                       200440
      WRITE(6,2001) DUM                                                 200450
      READ(5,1002) NREG,NSMAX,NMPT,LINPUT,NLDS,CYC1,CYCP,NLR,RCYC,PRES,
     1             IWORD,OMEGA,DUM
 1002 FORMAT(I2,I3,3I2,F6.0,F4.0,I2,4X,2F6.0,17X,I2,E14.7,T1,20A4)
      WRITE(6,2001) DUM                                                 200490
      READ(5,1008) AWORD,NX3,LDEF,CYCG,DUM
 1008 FORMAT(A4,I6,10X,9I1,2X,F4.0,T1,20A4)
      WRITE(6,2001) DUM                                                 200520
      DO 1500 J=1,3
      IF (WORD(J)-AWORD) 1500,1501,1500
 1500 CONTINUE                                                          200550
 1501 JPLS = J
      NLCASE = NPROB                                                    200630
      XN = 0                                                            200640
      NROW = 0                                                          200660
      KK = -1                                                           200670
      NSAVE = 0                                                         200680
      DO 13 I=1,NMPT                                                    200690
      KK = KK+2                                                         200700
      NXMAT(KK) = NROW+1                                                200710
      II = NROW+1                                                       200720
      READ(5,1004) STD(I),TYPE,DUM                                      200730
 1004 FORMAT(2(A4,6X),T1,20A4)                                          200740
      WRITE(6,2001) DUM                                                 200750
      NROW = 27
      DO 11 L=1,3                                                       200770
   11 IF (TYPE.EQ.MATER(L)) GO TO 12                                    200780
      NERROR = 1                                                        200790
      CALL ETRAP                                                        200800
      STD(I) = DLIMTR                                                   200810
      WRITE(6,223)                                                      200820
  223 FORMAT(28X,103H*   DUE TO INPUT ERROR IT IS IMPOSSIBLE TO CHECK TH 200830
     1E FOLLOWING CARDS UP TO THE DASH-SEPARATOR CARD.   */)            200840
      GO TO 2                                                           200850
   12 CONTINUE                                                          200860
      IF (L.EQ.1) NROW = 7
      IF (L.EQ.2) NROW = 17
      LLL = NSAVE+NROW                                                  200890
      READ(5,1005) ((XMAT(M,J),J=1,10),M=II,LLL)                        200900
 1005 FORMAT(5E14.7)                                                    200910
      WRITE(6,1205) ((XMAT(M,J),J=1,10),M=II,LLL)                       200920
 1205 FORMAT(1X,5E14.7)                                                 200930
      DO 608 M=3,10                                                     200940
      IF (XMAT(II,M-1).LT.XMAT(II,M)) GO TO 608                         200950
      IF (XMAT(II,M).EQ.0.0) GO TO 608                                  200960
      NERROR = 32                                                       200970
      CALL ETRAP                                                        200980
      STD(I) = D                                                        200990
  608 CONTINUE                                                          201000
      NROW = NSAVE+NROW                                                 201010
      NXMAT(KK+1) = LLL                                                 201020
   13 NSAVE = NROW                                                      201030
    2 READ(5,2000) DUM                                                  201040
      WRITE(6,2001) DUM                                                 201050
      IF (D.NE.DLIMTR) GO TO 2                                          201060
      WRITE(6,222)                                                      201070
  222 FORMAT(/)                                                         201080
      DO 99 NRC=1,NREG                                                  201090
```

```
      READ(5,1003) NST,NKL,NRING,DUM                                    201100
 1003 FORMAT(3I2,T1,20A4)                                               201110
      WRITE(6,2001) DUM                                                 201120
      NRNG(NRC) = NRING
      NSEGS(NRC) = NST
      IF (NRING.LE.28) GO TO 214                                        201130
      NERROR = 37                                                       201140
      CALL ETRAP                                                        201150
      WRITE(6,996) NRC                                                  201160
  996 FORMAT(/5X,'*   REGION NUMBER ',I2,'   *'///)                     201170
  214 CONTINUE                                                          201180
      READ(5,1006) JRTIC,JRSTOP,DUM                                     201190
 1006 FORMAT(5X,2I5,T1,20A4)                                            201200
      WRITE(6,2001) DUM                                                 201210
      NSEG = NST                                                        201220
      NSC = 0                                                           201230
  101 NSC = NSC+1                                                       201240
      NCHK = 0                                                          201250
      READ(5,1011) RGO,ANG,NLRS,DUM
 1011 FORMAT(F2.0,A1,I2,T1,20A4)
      WRITE(6,2001) DUM                                                 201280
C     GEOMETRY IDENTIFICATION SEARCH                                    201290
      DO 504 I=1,7                                                      201300
  504 IF (RGO.EQ.STRGO(I)) GO TO 505                                    201310
      NERROR = 2                                                        201320
      NCHK = 1                                                          201330
      CALL ETRAP                                                        201340
      WRITE(6,999) NRC,NSC                                              201350
      I = 8                                                             201360
  505 KGEOM = I                                                         201370
      MGEOM(NSC) = KGEOM                                                201380
      IF (KGEOM.EQ.5) WRITE(6,1233)                                     201390
 1233 FORMAT(/60X,'NOTE - FOR PLOT ROUTINE A/B=1.5, N=0 WILL BE USED.'/) 201400
      IF (RGO.NE.14.0) GO TO 280                                        201410
      ANGL(NSC) = ANG                                                   201420
      IF (ANG.EQ.A.OR.ANG.EQ.B) GO TO 280                               201430
      NERROR = 2                                                        201440
      NCHK = 1                                                          201450
      CALL ETRAP                                                        201460
      WRITE(6,999) NRC,NSC                                              201470
  280 CONTINUE                                                          201480
      READ(5,1012) DTAU,DIFF,STEP,APEX,DUM
 1012 FORMAT(3E14.1,3X,A4,T1,20A4)
      WRITE(6,2001) DUM                                                 201510
      IF (RGO.EQ.14.0) GO TO 180                                        201520
      READ(5,1015) G1,G2,G3,DUM                                         201530
 1015 FORMAT(3E14.1,T1,20A4)                                            201540
      WRITE(6,2001) DUM                                                 201550
      GG1(NSC) = G1                                                     201560
      GG2(NSC) = G2                                                     201570
      GG3(NSC) = G3                                                     201580
      GO TO 188                                                         201590
  180 READ(5,182) NRZIN,(ZI(J),RI(J),J=1,3),ZI(4),DUM                   201600
  182 FORMAT(I2,7F10.0,T1,20A4)                                         201610
      NRZN(NSC) = NRZIN                                                 201620
      IF (NRZIN.LE.14) GO TO 181                                        201630
      WRITE(6,2001) DUM                                                 201640
      NERROR = 39                                                       201650
      NCHK = 1                                                          201660
      CALL ETRAP                                                        201670
      WRITE(6,223)                                                      201680
```

```
      GO TO 3                                                          201690
  181 IF (NRZIN.LE.3) GO TO 185                                        201700
      IF (NRZIN.EQ.4) READ(5,186) RI(4)                                201710
  186 FORMAT(7F10.0)                                                   201720
      IF (NRZIN.GT.4) READ(5,186) RI(4),(ZI(J),RI(J),J=5,NRZIN)        201730
  185 CONTINUE                                                         201740
      WRITE(6,183) NRZIN,(ZI(J),RI(J),J=1,NRZIN)                       201750
  183 FORMAT(1X,I2,7F10.4/(1X,7F10.4))                                 201760
      DO 190 J=1,NRZIN                                                 201770
      ZJ(J,NSC) = ZI(J)                                                201780
  190 RJ(J,NSC) = RI(J)                                                201790
  188 CONTINUE                                                         201800
      READ(5,1013) TYPE,HLAYR,SHEET,INTERP,RANKIN,HARDEN,NP,DUM
 1013 FORMAT(6(A4,6X),10X,I2,T1,20A4)
      WRITE(6,2001) DUM                                                201830
      ICHK = 0                                                         201840
C     MATERIAL PROPERTY IDENTIFICATION                                 201850
      DO 501 I=1,NMPT                                                  201860
  501 IF (HLAYR.EQ.STD(I)) GO TO 502                                   201870
      NERROR = 4                                                       201880
      CALL ETRAP                                                       201890
      WRITE(6,999) NRC,NSC                                             201900
      ICHK = 2                                                         201910
      I = NMPT+1                                                       201920
  502 MAT = I                                                          201930
      JMAT(NRC,NSC) = MAT
      DO 506 I=1,3                                                     201940
  506 IF (TYPE.EQ.MATER(I)) GO TO 507                                  201950
      NERROR = 5                                                       201960
      CALL ETRAP                                                       201970
      WRITE(6,999) NRC,NSC                                             201980
      I = 4                                                            201990
  507 ITYPE = I                                                        202000
      DO 512 I=1,3
  512 IF (HARDEN.EQ.HARD(I)) GO TO 513
      NERROR = 26
      CALL ETRAP
      WRITE(6,999) NRC,NSC
  513 CONTINUE
      DO 510 I=1,12                                                    202010
  510 IF (INTERP.EQ.SEGTAB(I)) GO TO 511                               202020
      NERROR = 6                                                       202030
      CALL ETRAP                                                       202040
      WRITE(6,999) NRC,NSC                                             202050
      ICHK = 1                                                         202060
      I = 13                                                           202070
  511 ISTTAB = I                                                       202080
      KLUE2 = 1                                                        202090
      IF (ISTTAB.GE.3.AND.ISTTAB.LE.6) KLUE2 = 2                       202100
      DO 508 I=1,4                                                     202110
  508 IF (SHEET.EQ.FACE(I)) GO TO 509                                  202120
      NERROR = 7                                                       202130
      CALL ETRAP                                                       202140
      WRITE(6,999) NRC,NSC                                             202150
      ICHK = 1                                                         202160
      I = 5                                                            202170
  509 THICK = I                                                        202180
C     TEMPERATURE LOAD IDENTIFICATION                                  202190
      DO 401 I=1,4                                                     202200
  401 IF (RANKIN.EQ.THERM(I)) GO TO 402                                202210
      NERROR = 8                                                       202220
```

```
      CALL ETRAP                                                        202230
      WRITE(6,999) NRC,NSC                                              202240
      I = 5                                                             202250
  402 KELVIN = I                                                        202260
      KELVN(NRC,NSC) = KELVIN
      IF (NP.GE.2.AND.NP.LE.30) GO TO 191                               202270
      NERROR = 3                                                        202280
      NCHK = 1                                                          202290
      CALL ETRAP                                                        202300
      WRITE(6,999) NRC,NSC                                              202310
  999 FORMAT(/5X,'*   REGION NUMBER ',I2,5X,'SEGMENT NUMBER ',I2,'    *'  202320
     1       ///)                                                       202330
      WRITE(6,223)                                                      202340
      GO TO 3                                                           202350
  191 CONTINUE                                                          202360
      NPP(NRC,NSC) = NP
      IF (ICHK.EQ.1) WRITE(6,223)                                       202370
      IF (ICHK.EQ.1) GO TO 3                                            202380
      IWD = 1-IWORD
      NROW = 3-IWD
      IF (THICK.GT.1) NROW = THICK+3-2*IWD
      IF (ISTTAB.EQ.1) NROW = 14-3*IWD
      IF (ISTTAB.EQ.3) NROW = 16-3*IWD
      IF (ISTTAB.EQ.4) NROW = 10-2*IWD
      IF (ISTTAB.EQ.5) NROW = 12-3*IWD
      IF (ISTTAB.EQ.6) NROW = 13-3*IWD
      IF (ISTTAB.EQ.7) NROW = 9-2*IWD
      IF (ISTTAB.EQ.8) NROW = 11-3*IWD
      IF (ISTTAB.EQ.9) NROW = 12-3*IWD
      IF (ISTTAB.EQ.10) NROW = 15-3*IWD
      IF (ISTTAB.EQ.11) NROW = 17-4*IWD
      IF (ISTTAB.EQ.12) NROW = 18-4*IWD
      JROW(NRC,NSC) = NROW
      IF ((ISTTAB.NE.1.AND.ISTTAB.NE.3).OR.JPLS.NE.2) GO TO 290
      NERROR = 40
      CALL ETRAP
      WRITE(6,999) NRC,NSC
  290 CONTINUE
      DO 901 I=1,NROW                                                   202520
      READ(5,1005) (ST(I,J),J=1,NP)                                     202530
      WRITE(6,1205) (ST(I,J),J=1,NP)                                    202540
  901 CONTINUE                                                          202550
      STIC(NSC) = ST(1,1)                                               202560
      STP(NSC) = ST(1,NP)                                               202570
      IF (G1.EQ.0.0.AND.KGEOM.EQ.3) GO TO 902                           202580
      GO TO 903                                                         202590
  902 S = ST(1,1)/ST(1,NP)                                              202600
      IF (0.01.LT.S.AND.S.LT.100.0) GO TO 903                           202610
      NERROR = 33                                                       202620
      CALL ETRAP                                                        202630
      WRITE(6,998) NRC,NSC,LL                                           202640
  903 CONTINUE                                                          202650
      DO 2108 LL=1,NP                                                   202660
      HO = 1.0                                                          202670
      T = 1.0                                                           202680
      GO TO (711,600,711,32,33,34,35,36,37,28,29,30),ISTTAB             202690
  600 GO TO (701,702,703),THICK                                         202700
  703 HO = ST(4,LL)                                                     202710
  702 T = ST(3,LL)                                                      202720
  701 HI = ST(2,LL)                                                     202730
      GO TO 714                                                         202740
```

```
711 CONTINUE                                                                    202750
    XK11 = ST(2,LL)                                                             202760
    XK12 = ST(3,LL)                                                             202770
    XK22 = ST(4,LL)                                                             202780
    XK33 = ST(5,LL)                                                             202790
    XD11 = ST(6,LL)                                                             202800
    XD12 = ST(7,LL)                                                             202810
    XD22 = ST(8,LL)                                                             202820
    XD33 = ST(9,LL)                                                             202830
    XK21 = XK12                                                                 202840
    XD21 = XD12                                                                 202850
    GO TO 814                                                                   202860
 34 HO = ST(10,LL)                                                              202870
 33 T = ST(9,LL)                                                                202880
 32 HI = ST(8,LL)                                                               202890
    GO TO 851                                                                   202900
 37 HO = ST(9,LL)                                                               202910
 36 T = ST(8,LL)                                                                202920
 35 HI = ST(7,LL)                                                               202930
851 CONTINUE                                                                    202940
    SPH = ST(5,LL)                                                              202950
    IF (SPH.NE.0.0) GO TO 714                                                   202960
    NERROR = 9                                                                  202970
    CALL ETRAP                                                                  202980
    WRITE(6,998) NRC,NSC,LL                                                     202990
    GO TO 714                                                                   203000
 30 HO = ST(14,LL)                                                              203010
 29 T = ST(13,LL)                                                               203020
 28 HI = ST(12,LL)                                                              203030
    SPH = ST(10,LL)                                                             203040
    STH = ST(11,LL)                                                             203050
    IF (STH.NE.0.0) GO TO 850                                                   203060
    NERROR = 10                                                                 203070
    CALL ETRAP                                                                  203080
    WRITE(6,998) NRC,NSC,LL                                                     203090
850 IF (SPH.NE.0.0) GO TO 714                                                   203100
    NERROR = 11                                                                 203110
    CALL ETRAP                                                                  203120
    WRITE(6,998) NRC,NSC,LL                                                     203130
714 CONTINUE                                                                    203140
    IF (HO.NE.0.0) GO TO 802                                                    203150
    NERROR = 12                                                                 203160
    CALL ETRAP                                                                  203170
    WRITE(6,998) NRC,NSC,LL                                                     203180
802 IF (T.NE.0.0) GO TO 801                                                     203190
    NERROR = 13                                                                 203200
    CALL ETRAP                                                                  203210
    WRITE(6,998) NRC,NSC,LL                                                     203220
801 IF (HI.NE.0.0) GO TO 814                                                    203230
    IF (ISTTAB.EQ.6.OR.ISTTAB.EQ.9.OR.ISTTAB.EQ.12.OR.(ISTTAB.EQ.2.AND          203240
   1.THICK.EQ.3)) GO TO 710                                                     203250
    NERROR = 14                                                                 203260
    GO TO 712                                                                   203270
710 NERROR = 15                                                                 203280
712 CALL ETRAP                                                                  203290
    WRITE(6,998) NRC,NSC,LL                                                     203300
814 CONTINUE                                                                    203310
    IF (ITYPE.NE.3) GO TO 2108                                                  203320
    IF (ISTTAB.NE.1.AND.ISTTAB.NE.3) GO TO 2108                                 203330
    IF (XK11.NE.0.0) GO TO 2101                                                 203340
    NERROR = 16                                                                 203350
```

```
      CALL ETRAP                                                        203360
      WRITE(6,998) NRC,NSC,LL                                           203370
2101  IF (XK12.NE.0.0) GO TO 2104                                       203380
      NERROR = 17                                                       203390
      CALL ETRAP                                                        203400
      WRITE(6,998) NRC,NSC,LL                                           203410
2104  IF (XK21.NE.0.0) GO TO 2105                                       203420
      NERROR = 18                                                       203430
      CALL ETRAP                                                        203440
      WRITE(6,998) NRC,NSC,LL                                           203450
2105  IF (XK22.NE.0.0) GO TO 2106                                       203460
      NERROR = 19                                                       203470
      CALL ETRAP                                                        203480
      WRITE(6,998) NRC,NSC,LL                                           203490
2106  IF (XK33.NE.0.0) GO TO 2109                                       203500
      NERROR = 20                                                       203510
      CALL ETRAP                                                        203520
      WRITE(6,998) NRC,NSC,LL                                           203530
2109  IF (XD11.NE.0.0) GO TO 2110                                       203540
      NERROR = 21                                                       203550
      CALL ETRAP                                                        203560
      WRITE(6,998) NRC,NSC,LL                                           203570
2110  IF (XD12.NE.0.0) GO TO 2102                                       203580
      NERROR = 22                                                       203590
      CALL ETRAP                                                        203600
      WRITE(6,998) NRC,NSC,LL                                           203610
2102  IF (XD21.NE.0.0) GO TO 2103                                       203620
      NERROR = 23                                                       203630
      CALL ETRAP                                                        203640
      WRITE(6,998) NRC,NSC,LL                                           203650
2103  IF (XD22.NE.0.0) GO TO 2107                                       203660
      NERROR = 24                                                       203670
      CALL ETRAP                                                        203680
      WRITE(6,998) NRC,NSC,LL                                           203690
2107  IF (XD33.NE.0.0) GO TO 2108                                       203700
      NERROR = 25                                                       203710
      CALL ETRAP                                                        203720
      WRITE(6,998) NRC,NSC,LL                                           203730
2108  CONTINUE                                                          203740
      K = NROW+1                                                        203780
      JJ = 1                                                            203790
      JJJ = 6                                                           203800
      JT = JJ                                                           203840
      JTT = JJJ                                                         203850
      L = 0                                                             203860
      READ(5,1014) (LST(J),J=JJ,JJJ),DUM                               203870
1014  FORMAT(6I1,T1,20A4)                                               203880
      WRITE(6,2001) DUM                                                 203890
      IF (LST(JJ)) 8031,19,20                                           203900
   20 L = LST(JJ)                                                       203910
1026  IF ((LST(1).NE.1.AND.LST(JT).NE.1).AND.(KELVIN.EQ.3.OR.KELVIN.EQ.4 203970
     1)) GO TO 1027                                                     203980
      GO TO 1028                                                        203990
1027  NERROR = 35                                                       204000
      CALL ETRAP                                                        204010
      WRITE(6,999) NRC,NSC                                              204020
1028  IF ((LST(1).NE.4.AND.LST(JT).NE.4).AND.KELVIN.EQ.1) GO TO 1029    204030
      GO TO 1025                                                        204040
1029  NERROR = 35                                                       204050
      CALL ETRAP                                                        204060
      WRITE(6,999) NRC,NSC                                              204070
```

```
1025 IF (L.NE.1.AND.L.NE.4) GO TO 8031                                  204080
     GO TO 19                                                           204090
8031 NERROR = 27                                                        204100
     CALL ETRAP                                                         204110
     WRITE(6,999) NRC,NSC                                               204120
     WRITE(6,223)                                                       204130
     GO TO 3                                                            204140
  19 JJ = JJ+1                                                          204150
     IF (L.NE.0.AND.KELVIN.EQ.2) GO TO 8075                             204160
     GO TO 23                                                           204170
8075 NERROR = 35                                                        204180
     CALL ETRAP                                                         204190
     WRITE(6,999) NRC,NSC                                               204200
  23 IF (LST(JJ)) 8032,22,21                                            204210
  21 L = L+1                                                            204220
     IF (LST(JJ).NE.1) GO TO 8032                                       204230
  22 IF (JJ.EQ.JJJ) GO TO 24                                            204240
     JJ = JJ+1                                                          204250
     GO TO 23                                                           204260
8032 NERROR = 27                                                        204270
     CALL ETRAP                                                         204280
     WRITE(6,999) NRC,NSC                                               204290
     WRITE(6,223)                                                       204300
     GO TO 3                                                            204310
  24 IF (L.EQ.0) GO TO 71                                               204320
     IF (ICHK.EQ.2.AND.LST(JJ-5).NE.0) WRITE(6,223)                     204330
     LY = K                                                             204340
     KK = K+L-1                                                         204350
     DO 72 M=K,KK                                                       204360
     READ(5,1005) (ST(M,J),J=1,NP)                                      204370
     WRITE(6,1205) (ST(M,J),J=1,NP)                                     204380
  72 CONTINUE                                                           204390
  71 CONTINUE
 590 CONTINUE                                                           204460
     READ(5,591) IS,SAVJTC,SAVSTP,DUM                                   204470
 591 FORMAT(3I5,T1,20A4)                                                204480
     WRITE(6,2001) DUM                                                  204490
     IJT(NSC) = SAVJTC                                                  204500
     JJT(NSC) = SAVSTP                                                  204510
C    THE UPDATED INTERPOLATED VALUES OF THE MATERIAL PROPERTY COEFFIC   204520
C    IENTS ARE FOUND IN THE XMAT TABLE AND STORED IN THE XLAYER ARRAY   204530
     IF (LST(1).EQ.0) GO TO 3
     IF (ICHK.EQ.2) GO TO 3                                             204550
     IF (KELVIN.NE.5) GO TO 125                                         204560
     IF (LST(1).EQ.1) KELVIN = 3
     IF (LST(1).EQ.4) KELVIN = 1
 125 CONTINUE                                                           204590
     DO 123 LL=1,NP                                                     204600
     L=(MAT-1)*2+1                                                      204610
     II=NXMAT(L)                                                        204620
      III=NXMAT(L+1)                                                    204630
     M=1                                                                204640
     GO TO (91,123,93,93),KELVIN                                        204650
  91 TEMPAV = (ST(LY,LL)+ST(LY+1,LL)+ST(LY+2,LL)+ST(LY+3,LL))/4.0       204660
     ARG=TEMPAV                                                         204670
     GOTO 94                                                            204680
  93 ARG = ST(NROW + 1,LL)                                              204690
  94 DO 104 I = 2,10                                                    204700
     IF (ARG-XMAT(II,I)) 121,123,104                                    204710
 121 IF (I-2) 8007,8007,123                                             204720
8007 NERROR = 28                                                        204730
```

```
      CALL ETRAP                                                        204740
      WRITE(6,998) NRC,NSC,LL                                           204750
  998 FORMAT(/5X,'*   REGION NUMBER ',I2,5X,'SEGMENT NUMBER ',I2,5X,    204760
     1       'SEGMENT GEOMETRY TABLE ITEM ',I2,'   *'///)               204770
      GO TO 123                                                         204780
  104 CONTINUE                                                          204790
      NERROR = 29                                                       204800
      CALL ETRAP                                                        204810
      WRITE(6,998) NRC,NSC,LL                                           204820
  123 CONTINUE                                                          204830
    3 READ(5,2000) DUM                                                  204840
      WRITE(6,2001) DUM                                                 204850
      IF (D.NE.DLIMTR) GO TO 3                                          204860
      WRITE(6,222)                                                      204870
      JCHK(NSC) = NCHK                                                  204880
      IF (NSC.LT.NSEG) GO TO 101                                        204890
      NSC = 0                                                           204900
      IF (NRING.EQ.0) GO TO 210                                         204910
      DO 211 I=1,NRING                                                  204920
      READ(5,720) JTNO,(XDUM(J),J=1,5),DUM                              204930
  720 FORMAT(I2,5E14.7,T1,20A4)                                         204940
      WRITE(6,2001) DUM
      READ(5,723) (XDUM(J),J=1,5),DUM
  723 FORMAT(A4,2X,4E14.7,T1,20A4)
      WRITE(6,2001) DUM                                                 204950
      READ(5,721) XDUM,DUM                                              204960
  721 FORMAT(6E12.5,T1,20A4)                                            204970
      WRITE(6,2001) DUM                                                 204980
      IF (XDUM(2)) 780,780,781                                          204990
  780 WRITE(6,782)                                                      205000
  782 FORMAT(/  4X,'THE RING CENTROID RADIUS IS ZERO.'/)                 205010
      ICOUNT = ICOUNT+1                                                 205020
  781 CONTINUE                                                          205030
      READ(5,722) (XDUM(J),J=1,4),HARDEN,DUM
  722 FORMAT(4E14.7,4X,A4,T1,20A4)
      WRITE(6,2001) DUM                                                 205060
      DO 517 J=1,3
  517 IF (HARDEN.EQ.HARD(J)) GO TO 518
      NERROR = 36
      CALL ETRAP
  518 CONTINUE
      READ(5,721) XDUM,DUM
  211 WRITE(6,2001) DUM                                                 205090
  680 READ(5,2000) DUM                                                  205100
      WRITE(6,2001) DUM                                                 205110
      IF (D.NE.DLIMTR) GO TO 680                                        205120
      WRITE(6,222)                                                      205130
  210 CONTINUE                                                          205140
      NSKL = NKL                                                        205150
      IF (NSKL.EQ.0) GO TO 95                                           205160
      DO 103 NRIG=1,NSKL                                                205170
      READ(5,503) JDEP,JIND,ANGLE,DUM                                   205180
  503 FORMAT(2I2,E14.7,T1,20A4)                                         205190
      WRITE(6,2001) DUM                                                 205200
      JLINK(NRIG) = JDEP                                                205210
      ILINK(NRIG) = JIND                                                205220
      ANGLNK(NRIG) = ANGLE                                              205230
      IF (JIND.LT.JDEP) GO TO 103                                       205240
      NERROR = 30                                                       205250
      CALL ETRAP                                                        205260
  103 CONTINUE                                                          205270
```

```
  4 READ(5,2000) DUM                                                    205280
    WRITE(6,2001) DUM                                                   205290
    IF (D.NE.DLIMTR) GO TO 4                                            205300
    WRITE(6,222)                                                        205310
 95 NSEG = NST                                                          205320
    NLINK = NKL                                                         205330
    DO 3030 ISEG = 1,NSEG                                               205340
    NCHK = JCHK(ISEG)                                                   205350
    KSEG = ISEG                                                         205360
    IF (MGEOM(ISEG).NE.6) GO TO 195                                     205370
    ANG = ANGL(ISEG)                                                    205380
    NRZIN = NRZN(ISEG)                                                  205390
    IF (NRZIN.GE.15) GO TO 195                                          205400
    DO 192 I=1,NRZIN                                                    205410
    ZI(I) = ZJ(I,ISEG)                                                  205420
192 RI(I) = RJ(I,ISEG)                                                  205430
195 CONTINUE                                                            205440
    CALL GRAPH (NCHK,NRC)                                               205450
    IF (NCHK.EQ.1) GO TO 3031                                           205460
3030 CONTINUE                                                           205470
3031 NZR = NRC                                                          205480
    JCLUE = 0                                                           205490
    IF (NCHK.EQ.1.AND.KSEG.EQ.1) JCLUE = 1                              205500
    IF (NCHK.EQ.1.AND.KSEG.GT.1) JCLUE = 2                              205510
    CALL ZPLOT (JCLUE)                                                  205520
 99 CONTINUE                                                            205530
    READ(5,601) NOJ,NORING,NLINK,DUM                                    205540
601 FORMAT(3I5,T1,20A4)                                                 205550
    WRITE(6,2001) DUM                                                   205560
    IF (NORING.LE.28) GO TO 750                                         205570
    NERROR = 38                                                         205580
    CALL ETRAP                                                          205590
750 CONTINUE                                                            205600
    IF (NORING.EQ.0) GO TO 751                                          205610
    DO 752 I=1,NORING                                                   205620
    READ(5,720) JTNO,(XDUM(J),J=1,5),DUM                                205630
    WRITE(6,2001) DUM                                                   205640
    READ(5,723) (XDUM(J),J=1,5),DUM
    WRITE(6,2001) DUM
    READ(5,721) XDUM,DUM                                                205650
    WRITE(6,2001) DUM                                                   205660
    IF (XDUM(2)) 783,783,784                                            205670
783 WRITE(6,782)                                                        205680
    ICOUNT = ICOUNT+1                                                   205690
784 CONTINUE                                                            205700
    READ(5,722) (XDUM(J),J=1,4),HARDEN,DUM
    WRITE(6,2001) DUM                                                   205720
    DO 519 J=1,3
519 IF (HARDEN.EQ.HARD(J)) GO TO 520
    NERROR = 36
    CALL ETRAP
520 CONTINUE
    READ(5,721) XDUM,DUM
752 WRITE(6,2001) DUM                                                   205740
681 READ(5,2000) DUM                                                    205750
    WRITE(6,2001) DUM                                                   205760
    IF (D.NE.DLIMTR) GO TO 681                                          205770
    WRITE(6,222)                                                        205780
751 CONTINUE                                                            205790
    IF (NLINK.EQ.0) GO TO 3108                                          205800
    DO 602 NRIG=1,NLINK                                                 205810
```

```
      READ(5,603) JD,JI,COTAN,DUM                                    205820
  603 FORMAT(2I2,E14.7,T1,20A4)                                      205830
      WRITE(6,2001) DUM                                              205840
      LST(NRIG) = JD                                                 205850
      IF (NRIG.EQ.1) GO TO 605                                       205860
      IF (JDD.LT.JD) GO TO 605                                       205870
      NERROR = 31                                                    205880
      CALL ETRAP                                                     205890
      IF (JDD.GE.JD) GO TO 602                                       205900
  605 JDD = JD                                                       205910
  602 CONTINUE                                                       205920
    5 READ(5,2000) DUM                                               205930
      WRITE(6,2001) DUM                                              205940
      IF (D.NE.DLIMTR) GO TO 5                                       205950
      WRITE(6,222)                                                   205960
 3108 CONTINUE                                                       205970
      DO 109 J=1,NOJ                                                 205980
      READ(5,110) JN,DLP,ANGLE,DUM                                   205990
  110 FORMAT(I2,4F2.0,E14.1,T1,20A4)                                 206000
      WRITE(6,2001) DUM                                              206010
      IF (NLINK.EQ.0) GO TO 109                                      206020
      DO 130 N=1,NLINK                                               206030
      IF (JN.EQ.LST(N)) GO TO 132                                    206040
  130 CONTINUE                                                       206050
      GO TO 109                                                      206060
  132 DO 131 I=1,4                                                   206070
      IF (DLP(I).EQ.0.0) GO TO 131                                   206080
      NERROR = 34                                                    206090
      CALL ETRAP                                                     206100
      GO TO 109                                                      206110
  131 CONTINUE                                                       206120
  109 CONTINUE                                                       206130
    6 READ(5,2000) DUM                                               206140
      WRITE(6,2001) DUM                                              206150
      IF (D.NE.DLIMTR) GO TO 6                                       206160
      WRITE(6,222)                                                   206170
      READ(5,302) LINLOD,DUM                                         206190
  302 FORMAT(I4,T1,20A4)                                             206200
      WRITE(6,2001) DUM                                              206210
      IF (LINLOD.EQ.0) GO TO 7                                       206220
      DO 304 N=1,LINLOD                                              206230
      READ(5,305) JEXT1,XFL,DUM
  305 FORMAT(5X,I5,E14.7,T1,20A4)
      WRITE(6,2001) DUM                                              206260
  304 CONTINUE                                                       206270
    7 READ(5,2000) DUM                                               206280
      WRITE(6,2001) DUM                                              206290
      IF (D.NE.DLIMTR) GO TO 7                                       206300
      WRITE(6,222)                                                   206310
  303 CONTINUE                                                       206320
  887 IF (NLDS.LE.ICT) GO TO 888
      CALL CYCLE
      ICT = ICT+1
      GO TO 887
  888 IF (ICOUNT.EQ.0) GO TO 889                                     206560
      WRITE(6,866) ICOUNT                                            206570
  866 FORMAT(10(/),100X,I5,' ERRORS LOCATED.')                       206580
      GO TO 1                                                        206590
  889 WRITE(6,865)                                                   206600
  865 FORMAT(10(/),100X,'NO DETECTABLE ERRORS FOUND.')               206610
      GO TO 1                                                        206620
```

```
555 CALL ENDJOB                                          206640
    STOP                                                 206650
    END
```

```
FOR,IS GRAPH,GRAPH
      SUBROUTINE GRAPH (NCHK,NRC)                                        300010
      COMMON/GRAPHS/STIC(30),STP(30),G1(30),G2(30),G3(30),               300020
     1IREGC,ISEG ,NSEG,MGEOM(30),JLINK(30),ILINK(30),ANGLNK(30),NLINK,   300030
     2JJT(30),IJT(30)                                                    300040
      COMMON/GPLOT/ZZ(600),RRAD(600),NPT,NZR                             300050
      COMMON /SPLINS/ ANG,PSI(100),RADR(100),ZI(14),RI(14),NRZIN,        300060
     1                POLY(10),NCOEF                                     300070
      COMMON NERROR                                                      300080
      DIMENSION PHI(20),RAD(20),Z(20)
      DIMENSION IDARY(2)
      DIMENSION R(3),ZE(9)                                               300100
      DATA IDARY/'HARDCO','PY
      DATA AAA/'A   '/                                                   300110
      DO 600 I=1,20                                                      300120
      RAD(I) = 0.0                                                       300130
  600 Z(1) = 0.0                                                         300140
      IF(ISEG .NE.1)GO TO 20                                             300150
      NPT=0                                                              300160
      RELOR = 0.0                                                        300170
      IF(IREGC .NE.1)GO TO 20                                            300180
      CALL IDENT (9,IDARY)
      IREGC = 2                                                          300200
   20 IF (NCHK.EQ.1) GO TO 999                                           300210
      MG = MGEOM(ISEG)                                                   300220
      GO TO (30,30,80,70,30,30,160,999),MG                               300230
   30 CONTINUE                                                           300240
      DELTA=(STP(ISEG)-STIC(ISEG))/19.0                                  300250
      DO 50 I = 1,19                                                     300260
      PHI(I)= (I-1)*DELTA + STIC(ISEG)                                   300270
   50 CONTINUE                                                           300280
      PHI(20)= STP(ISEG)                                                 300290
   60 GO TO(100,90,80,70,130,120,160),MG                                 300300
C                                                                        300310
C     CYLINDER                                                           300320
C                                                                        300330
   70 CONTINUE                                                           300340
      NUMPT= 2                                                           300350
      RAD(1) = G1(ISEG)                                                  300360
      RAD(2) = RAD(1)                                                    300370
      Z(1) = STP(ISEG)-STIC(ISEG)                                        300380
      Z(2)= 0.0                                                          300390
      GO TO 200                                                          300400
C                                                                        300410
C     CONE                                                               300420
C                                                                        300430
   80 CONTINUE                                                           300440
      PHIANG= G1(ISEG)                                                   300450
      COSP= COS(PHIANG)                                                  300460
      RAD(1)= STIC(ISEG)* COSP                                           300470
      RAD(2)= STP(ISEG)*  COSP                                           300480
      Z(1)= SIN(PHIANG)*(STP(ISEG)-STIC(ISEG))                           300490
      Z(2)= 0.0                                                          300500
      NUMPT = 2                                                          300510
      GO TO 200                                                          300520
C                                                                        300530
C     OGIVE                                                              300540
C                                                                        300550
   90 CONTINUE                                                           300560
```

```
      COSP= COS(STP(ISEG))                                              300570
      DO 95 I=1,20                                                      300580
      RAD(I)= (G1(ISEG)*SIN(PHI(I))) - G2(ISEG)                         300590
      Z(I)= G1(ISEG)*(COS(PHI(I))-COSP)                                 300600
   95 CONTINUE                                                          300610
      Z(20)= 0.0                                                        300620
      NUMPT =20                                                         300630
      GO TO 200                                                         300640
C                                                                       300650
C     ELIPSE-(G3 IS OFFSET DISTANCE)                                    300660
C                                                                       300670
  100 CONTINUE                                                          300680
      BB= G2(ISEG)                                                      300690
      C= G3(ISEG)                                                       300700
      A= G1(ISEG)                                                       300710
      B= G2(ISEG)* A                                                    300720
      DO 109 I=1,20                                                     300730
      COSP= COS(PHI(I))                                                 300740
      SINP= SIN(PHI(I))                                                 300750
      RAD(I) = SINP*A/((SINP**2+BB**2*COSP**2)**.5)-C                   300760
      Z(I) = B*SQRT(1.0-(RAD(I)+C)**2/A**2)                             300770
      IF (PHI(I).GT.1.5708.AND.PHI(I).LT.4.61239) Z(I) = -Z(I)          300780
  109 CONTINUE                                                          300790
      DO 107 I=1,20                                                     300800
  107 Z(I) = Z(I)-Z(20)                                                 300810
      NUMPT = 20                                                        300820
      GO TO 200                                                         300830
C                                                                       300840
C     GENERAL GEOMETRY                                                  300850
C                                                                       300860
  120 CONTINUE                                                          300870
      CALL GEOMET                                                       300880
      DO 450 K=1,20                                                     300890
      ARG = PHI(K)                                                      300900
      DO 404 J=1,100                                                    300910
      PHO = PSI(J)                                                      300920
      IF (ANG.EQ.AAA) IF (ARG-PHO) 421,423,404                          300930
      IF (PHO-ARG) 421,423,404                                          300940
  421 IF (J-1) 8502,8502,424                                            300950
  404 CONTINUE                                                          300960
      GO TO 8503                                                        300970
  423 RAD(K) = RADR(J)                                                  300980
      GO TO 450                                                         300990
 8502 NERROR = 56                                                       301000
      CALL ETRAP                                                        301010
      WRITE(6,989) NRC,ISEG                                             301020
  989 FORMAT(/5X,'*   REGION NUMBER ',I2,5X,'SEGMENT NUMBER ',I2,'   *  301030
     1       ///).                                                      301040
      NCHK = 1                                                          301050
      GO TO 999                                                         301060
 8503 NERROR = 57                                                       301070
      CALL ETRAP                                                        301080
      WRITE(6,989) NRC,ISEG                                             301090
      NCHK = 1                                                          301100
      GO TO 999                                                         301110
  424 SUB1 = ARG-PSI(J-1)                                               301120
      SUB2 = PSI(J)-PSI(J-1)                                            301130
      RAD(K) = RADR(J-1)+(RADR(J)-RADR(J-1))*SUB1/SUB2                  301140
  450 CONTINUE                                                          301150
      RMAX = RI(1)                                                      301160
      RMIN = RI(1)                                                      301170
```

```
      DO 365 K=2,NRZIN                                                  301180
      IF (RI(K).LT.RMIN) RMIN = RI(K)                                   301190
      IF (RI(K).GT.RMAX) RMAX = RI(K)                                   301200
  365 CONTINUE                                                          301210
      DO 401 J=1,20                                                     301220
      IF (RAD(J).LT.RMIN) RAD(J) = RMIN                                 301230
      IF (RAD(J).GT.RMAX) RAD(J) = RMAX                                 301240
  401 CONTINUE                                                          301250
      P1 = 3.1415926/2.0                                                301260
      P3 = 3.0*P1                                                       301270
      DO 449 J=1,20                                                     301280
      PHO = PHI(J)                                                      301290
      IF (PHO.LT.P1.OR.PHO.GT.P3) GO TO 353                             301300
      AA = RI(1)                                                        301310
      III = 1                                                           301320
      C = AA                                                            301330
      I = III                                                           301340
      JJ = 1                                                            301350
      DO 451 K=2,NRZIN                                                  301360
      IF (ANG.EQ.AAA) IF (RAD(J)-RI(K)) 350,360,452                     301370
      IF (RI(K)-RAD(J)) 350,360,452                                     301380
  350 C = RI(K)                                                         301390
      I = K                                                             301400
      JJ = I                                                            301410
  451 CONTINUE                                                          301420
  452 D = RI(K)                                                         301430
      II = K                                                            301440
      JJJ = II                                                          301450
      IF (I.NE.1) GO TO 460                                             301460
      AA = RI(K+1)                                                      301470
      III = K+1                                                         301480
      R(1) = C                                                          301490
      R(2) = D                                                          301500
      R(3) = AA                                                         301510
      ZE(4) = ZI(I)                                                     301520
      ZE(5) = ZI(II)                                                    301530
      ZE(6) = ZI(III)                                                   301540
      GO TO 480                                                         301550
  460 CONTINUE                                                          301560
      AA = RI(K-2)                                                      301570
      III = K-2                                                         301580
      R(1) = AA                                                         301590
      R(2) = C                                                          301600
      R(3) = D                                                          301610
      ZE(4) = ZI(III)                                                   301620
      ZE(5) = ZI(I)                                                     301630
      ZE(6) = ZI(II)                                                    301640
      GO TO 480                                                         301650
  353 AA = RI(NRZIN)                                                    301660
      III = NRZIN                                                       301670
      C = A                                                             301680
      I = III                                                           301690
      JJ = NRZIN                                                        301700
      L = NRZIN-1                                                       301710
      K = L                                                             301720
      DO 453 M=1,L                                                      301730
      IF (ANG.EQ.AAA) IF (RAD(J)-RI(K)) 349,360,454                     301740
      IF (RI(K)-RAD(J)) 349,360,454                                     301750
  349 C = RI(K)                                                         301760
      I = K                                                             301770
      JJ = I                                                            301780
```

```
      K = K-1                                                          301790
  453 CONTINUE                                                         301800
  454 D = RI(K)                                                        301810
      II = K                                                           301820
      JJJ = II                                                         301830
      IF (I.NE.NRZIN) GO TO 470                                        301840
      AA = RI(K-1)                                                     301850
      III = K-1                                                        301860
      R(1) = C                                                         301870
      R(2) = D                                                         301880
      R(3) = AA                                                        301890
      ZE(4) = ZI(I)                                                    301900
      ZE(5) = ZI(II)                                                   301910
      ZE(6) = ZI(III)                                                  301920
      GO TO 480                                                        301930
  470 CONTINUE                                                         301940
      AA = RI(K+2)                                                     301950
      III = K+2                                                        301960
      R(1) = AA                                                        301970
      R(2) = C                                                         301980
      R(3) = D                                                         301990
      ZE(4) = ZI(III)                                                  302000
      ZE(5) = ZI(I)                                                    302010
      ZE(6) = ZI(II)                                                   302020
  480 CONTINUE                                                         302030
      ZE(1) = ZE(4)*ZE(4)                                              302040
      ZE(2) = ZE(5)*ZE(5)                                              302050
      ZE(3) = ZE(6)*ZE(6)                                              302060
      ZE(7) = 1.0                                                      302070
      ZE(8) = 1.0                                                      302080
      ZE(9) = 1.0                                                      302090
      IF (PHO.GE.P1.AND.PHO.LE.P3) GO TO 370                           302100
      ITMP = JJ                                                        302110
      JJ = JJJ                                                         302120
      JJJ = ITMP                                                       302130
  370 CONTINUE                                                         302140
      CALL SIMQ (ZE,R)                                                 302150
      AA = R(1)                                                        302160
      BB = R(2)                                                        302170
      CC = R(3)                                                        302180
      DISC = BB*BB-4.0*AA*(CC-RAD(J))                                  302190
      IF (DISC.LT.0.0) GO TO 8777                                      302200
      Z1 = (-BB+SQRT(DISC))/(2.0*AA)                                   302210
      Z2 = (-BB-SQRT(DISC))/(2.0*AA)                                   302220
      IF (Z1.GE.ZI(JJ).AND.Z1.LE.ZI(JJJ)) Z(J) = Z1                    302230
      IF (Z2.GE.ZI(JJ).AND.Z2.LE.ZI(JJJ)) Z(J) = Z2                    302240
      GO TO 449                                                        302250
 8777 WRITE(6,8778) J                                                  302260
 8778 FORMAT(//' FOR J =',I3,' THE ROOTS ARE IMAGINARY')               302270
      GO TO 449                                                        302280
  360 Z(J) = ZI(K)                                                     302290
  449 CONTINUE                                                         302300
      NUMPT = 20                                                       302310
      GO TO 200                                                        302320
C                                                                      302330
C     MODIFIED ELIPSE                                                  302340
C                                                                      302350
  130 CONTINUE                                                         302360
      A = G2(ISEG)                                                     302370
      DO 110 I=1,20                                                    302380
      COSP = COS(PHI(I))                                               302390
```

```
      SINP = SIN(PHI(I))                                                302400
      SINP1 = 1.0/(SINP+1.0)                                            302410
      RAD(I) = 2.0*A*SINP*SINP1                                         302420
  110 Z(I) = 2.0*A*COSP*(2.0-SINP1)/(3.0*(SINP+1.0))                    302430
      DO 111 I=1,20                                                     302440
  111 Z(I) = Z(I)-Z(20)                                                 302450
      NUMPT = 20                                                        302460
      GO TO 200                                                         302470
C                                                                       302480
C     DUMMY GEOMETRY                                                    302490
C                                                                       302500
  160 CONTINUE                                                          302510
  200 CONTINUE                                                          302520
      IF(ISEG .NE.1)GO TO 220                                           302530
      IF(JJT(1) .GT. IJT(1))GO TO 230                                   302540
      GO TO 250                                                         302550
  220 CALL KLINK(IRET,LNKNUM)                                           302560
      GO TO (230,250,230,250),IRET                                      302570
C                                                                       302580
C     CONNECTED AT ITH-JOINT                                            302590
C                                                                       302600
  230 CONTINUE                                                          302610
      Z1 = Z(1)                                                         302620
      DO 240 I=1,NUMPT                                                  302630
      Z(I) = Z(I) - Z1                                                  302640
  240 CONTINUE                                                          302650
      GO TO 270                                                         302660
C                                                                       302670
C     CONNECTED AT J-JOINT                                              302680
C                                                                       302690
  250 INDX= NUMPT/2                                                     302700
      DO 260 I=1,INDX                                                   302710
      K= NUMPT+1-I                                                      302720
      TEMPZ= Z(I)                                                       302730
      TEMPR= RAD(I)                                                     302740
      Z(I)= Z(K)                                                        302750
      RAD(I)=RAD(K)                                                     302760
      Z(K)= TEMPZ                                                       302770
      RAD(K)= TEMPR                                                     302780
  260 CONTINUE                                                          302790
C                                                                       302800
C     ADD LAST RELATIVE ORIGIN                                          302810
C                                                                       302820
  270 DO 280 I=1,NUMPT                                                  302830
      Z(I) = Z(I)+RELOR                                                 302840
  280 CONTINUE                                                          302850
      RELOR = Z(NUMPT)                                                  302860
      IF(ISEG .EQ.1)GO TO 300                                           302870
      GO TO (300,300,290,290),IRET                                      302880
C                                                                       302890
C     KINEMATIC LINK AT THIS JOINT-ADJUST Z-COORDINATE                  302900
C                                                                       302910
  290 DZ=(RAD(1)-RADOLD)* COTAN(ANGLNK(LNKNUM))                         302920
      DO 295 I=1,NUMPT                                                  302930
      Z(I)= Z(I) + DZ                                                   302940
  295 CONTINUE                                                          302950
      D = COTAN(ANGLNK(LNKNUM))                                         302960
  300 RADOLD=RAD(NUMPT)                                                 302970
      RELOR = Z(NUMPT)                                                  302980
      DO 310 I=1,NUMPT                                                  302990
      RRAD( I+NPT)= RAD(I)                                              303000
```

```
      ZZ(  I+NPT) = Z(I)                                          303010
  310 CONTINUE                                                    303020
      NPT=NPT+NUMPT                                               303030
  999 RETURN                                                      303040
      END                                                         303050
```

```
FOR,IS KLINK,KLINK
      SUBROUTINE KLINK(IRET,LNKNUM)                                    400010
      COMMON/GRAPHS/STIC(30),STP(30),G1(30),G2(30),G3(30),             400020
     1IREGC,ISEG ,NSEG,MGEOM(30),JLINK(30),ILINK(30),ANGLNK(30),NLINK, 400030
     2JJT(30),IJT(30)                                                 400040
      ISEGC = ISEG                                                     400050
      IF(IJT(ISEGC).EQ. IJT(ISEGC-1).OR.IJT(ISEGC).EQ.JJT(ISEGC-1))    400060
     1GO TO 10                                                         400070
      IF(JJT(ISEGC).NE. IJT(ISEGC-1).AND. JJT(ISEGC).NE.JJT(ISEGC-1))  400080
     1GO TO 30                                                         400090
C     CONNECTED AT J-JOINT                                             400100
      IRET= 2                                                          400110
      GO TO 100                                                        400120
C     CONNECTED AT I-TH JOINT                                          400130
   10 IRET= 1                                                          400140
      GO TO 100                                                        400150
C                                                                      400160
C     IS THERE A KINEMATIC LINK                                        400170
C                                                                      400180
   30 DO 50 I=1,NLINK                                                  400190
      IF(IJT(ISEGC).EQ. JLINK(I))GO TO 40                              400200
      IF(JJT(ISEGC).NE. JLINK(I))GO TO 50                              400210
      IRET= 4                                                          400220
      GO TO 45                                                         400230
   40 IRET=3                                                           400240
   45 LNKNUM= I                                                        400250
      GO TO 100                                                        400260
   50 CONTINUE                                                         400270
      WRITE(6,60)                                                      400280
   60 FORMAT(/,1X,'***-ERROR-UNCONNECTED JOINT BETWEEN SEGMENTS' )     400290
      STOP                                                             400300
  100 RETURN                                                           400310
      END                                                              400320
```

```
FOR,IS ZPLOT,ZPLOT
      SUBROUTINE ZPLOT (JCLUE)
      COMMON/GRAPHS/STIC(30),STP(30),G1(30),G2(30),G3(30),
     1IREGC,ISEG ,NSEG,MGEOM(30),JLINK(30),ILINK(30),ANGLNK(30),NLINK,
     2JJT(30),IJT(30)
      COMMON /GPLOT/ ZZ(600),RRAD(600),NPT,NZR,DX
      DIMENSION YTITLE(12),XTITLE(12)
      DIMENSION TITLE(12)
      DIMENSION ALPHA(3)
      EXTERNAL TABL1V
      DATA YTITLE/'Z - AX','IS    ',10*6H      /
      DATA XTITLE/'RADIUS',' OF RE','VOLUTI','ON    ',8*6H      /
      DATA TITLE/'     R','EGION ','NUMBER','      ','      ','      ',
     1          '      ',' SEGME','NTS   ','      ','      ',' LINKS'/
      CALL CHSIZV (2,2)
      CALL RITSTV (13,19,TABL1V)
C
      DS = DX
      IF (JCLUE.EQ.1) GO TO 200
      YMIN = ZZ(1)
      YMAX = ZZ(1)
      XMIN = 0.0
      XMAX = RRAD(1)
      DO 400 J=2,NPT
      IF (ZZ(J).LE.YMIN) YMIN = ZZ(J)
      IF (ZZ(J).GT.YMAX) YMAX = ZZ(J)
      IF (RRAD(J).GT.XMAX) XMAX = RRAD(J)
  400 CONTINUE
      IF (DX.NE.0.0) GO TO 500
      DX = XMAX-XMIN
      DV = YMAX-YMIN
      IF (DV.LT.DX) DV = DX
      GO TO 600
  500 DV = DX
  600 CONTINUE
      YDIF = (YMAX-YMIN)/2.0+YMIN
      YMIN = YDIF-DV/2.0
      YMAX = YDIF+DV/2.0
      XDIF = (XMAX-XMIN)/2.0+XMIN
      XMIN = XDIF-DV/2.0
      XMAX = XDIF+DV/2.0
      CALL SCRND (XMAX,XMIN,XMX,XMN)
      CALL SCRND (YMAX,YMIN,YMX,YMN)
      CALL QUIK3L (-1,XMN,XMX,YMN,YMX,1HX,XTITLE,YTITLE,-NPT,RRAD,ZZ)
  200 IF (JCLUE.EQ.1) CALL FRAMEV (2)
      ENCODE (801,ALPHA) NZR,NSEG,NLINK
  801 FORMAT(3I6)
      TITLE(4) = ALPHA(1)
      TITLE(7) = ALPHA(2)
      TITLE(11) = ALPHA(3)
      CALL RITE2V (46,1005,1023,90,1,72,1,TITLE,IERR)
      IF (JCLUE.EQ.0) GO TO 99
      CALL CHSIZV (9,9)
      CALL RITSTV (48,68,TABL1V)
      I = 100
      J = 900
      CALL RITE2V (I,J,1023,90,1,6,1,6HDUE TO,IERR)
      J = J-100
      CALL RITE2V (I,J,1023,90,1,5,1,5HINPUT,IERR)
      J = J-100
      CALL RITE2V (I,J,1023,90,1,5,1,5HERROR,IERR)
```

```
      IF (JCLUE.EQ.1) GO TO 100
      J = J-100
      CALL RITE2V (I,J,1023,90,1,11,1,11HTHE REST OF,IERR)
  100 J = J-100
      CALL RITE2V (I,J,1023,90,1,11,1,11HTHIS REGION,IERR)
      J = J-100
      CALL RITE2V (I,J,1023,90,1,6,1,6HIS NOT,IERR)
      J = J-100
      CALL RITE2V (I,J,1023,90,1,9,1,9HGRAPHABLE,IERR)
   99 CONTINUE
      DX = DS
      RETURN
      END
```

```
 FOR,IS GEOMET,GEOMET
       SUBROUTINE GEOMET                                                  600010
C      THIS SUBROUTINE CALCULATES THE GEOMETRY FOR A SHELL SEGMENT.       600020
C      THE INPUT VARIABLES ARE . . .                                      600030
C              RI(I) - - DISTANCE FROM AXIS OF REV. TO POINTS             600040
C                        ON SHELL MERIDIAN.                               600050
C              ZI(I) - - DISTANCE ALONG AXIS OF REV. TO THE               600060
C                        INTERSECTION OF THE CORRESPONDING RI(I) AND      600070
C                        THE AXIS OF REV.                                 600080
C              NRZIN - - NUMBER OF (RI,ZI) PAIRS READ AS INPUT.           600090
C                                                                         600100
       COMMON /SPLINS/ ANG,PSI(100),RADR(100),ZI(14),RI(14),NRZIN,       600110
      1                POLY(10),NCOEF                                     600120
       DIMENSION CI(4,13),DRDZ(14),SOUT(14),S(101),RADD(100)              600130
C      .                                                                  600140
       FUN(ARG) = SQRT(1.0 + ARG**2)                                      600150
C                                                                         600160
       RADS = 3.1415926/180.0                                             600170
       DATA B/'B   '/                                                     600180
       AMULT = 1.0                                                        600190
       IF (ANG.EQ.B) AMULT = -1.0                                         600200
C                                                                         600210
C      PASS SPLINE CURVE THROUGH INPUT POINTS ON SHELL MERIDIAN, AND      600220
C      COMPUTE DR/DZ AT THESE POINTS.                                     600230
C                                                                         600240
       CALL PLICO (ZI,RI,NRZIN,CI)                                        600250
       NDELZ = NRZIN - 1                                                  600260
       DO 60 I=1,NRZIN                                                    600270
       CALL PLINE (ZI,RI,NRZIN,CI,ZI(I),FAKE1,DRDZ(I),FAKE2)              600280
    60 CONTINUE                                                           600290
C                                                                         600300
C      COMPUTE MERIDIONAL ARC LENGTH TO INTERPOLATED POINTS BY            600310
C      NUMERICAL INTEGRATION (SIMPSONS RULE).  SINCE SIMPSONS RULE        600320
C      REQUIRES AN EVEN NUMBER OF PARTITIONS, INTERPOLATE A POINT         600330
C      MIDWAY BETWEEN EACH PAIR OF POINTS USING SUBROUTINE SPLINE.        600340
C                                                                         600350
       SOUT(1) = 0.                                                       600360
       DO 70 I=1,NDELZ                                                    600370
       DZ2=(ZI(I+1)-ZI(I))/2.0                                            600380
       DZ6=DZ2/3.0                                                        600390
       CALL PLINE (ZI,RI,NRZIN,CI,ZI(I)+DZ2,FAKE1,DRDZM,FAKE2)            600400
       SOUT(I+1) = SOUT(I) + DZ6*(FUN(DRDZ(I)) + 4.0*FUN(DRDZM) +         600410
      1            FUN(DRDZ(I+1)))                                       600420
    70 CONTINUE                                                           600430
C                                                                         600440
C      USE SPLICO TO REPRESENT RI(I) AS A FUNCTION OF SOUT(I).  THEN USE  600450
C      SPLINE TO INTERPOLATE RADD.                                        600460
C                                                                         600470
       OLDH1 = SOUT(NRZIN)/99.0                                           600480
   100 CALL PLICO (SOUT,RI,NRZIN,CI)                                      600490
       DO 110 I=1,100                                                     600500
       S(I) = FLOAT(I-1)*OLDH1                                            600510
       CALL PLINE (SOUT,RI,NRZIN,CI,S(I),RADR(I),RADD(I),RADD2)           600520
       IF (ABS(RADD(I)).GT.1.0) RADD(I)=1.0                               600530
   110 CONTINUE                                                           600540
       DO 180 J=1,100                                                     600550
       COSPSI = AMULT*RADD(J)                                             600560
       PSI(J) = ARCOS(COSPSI)                                             600570
       IF (ANG.EQ.B) GO TO 180                                            600580
       PSI(J) = 2.0*3.1415926-PSI(J)                                      600590
   180 CONTINUE                                                           600600
```

```
      XC22 = ST(11,LL)                                                  703070
      XC15 = ST(12,LL)                                                  703080
      XC16 = ST(13,LL)                                                  703090
      XMERD = ST(NCONT-2,LL)                                            703100
      XPRES = ST(NCONT-1,LL)                                            703110
      XMONT = ST(NCONT,LL)                                              703120
      XK21 = XK12                                                       703130
      XD21 = XD12                                                       703140
      GO TO 103                                                         703150
C                                                                       703160
   40 CONTINUE                                                          703170
      IF (IWORD.EQ.1) GO TO 140                                         703180
      RHOR = 0.0                                                        703190
      RHOS = 0.0                                                        703200
      RHOI = 0.0                                                        703210
      RHOC = 0.0                                                        703220
      XMERD = 0.0                                                       703230
      XPRES = 0.0                                                       703240
      XMONT = 0.0                                                       703250
  140 CONTINUE                                                          703260
      TEMP3= (1.0-XNUPT * XNUTP)                                        703270
      GO TO (42,47,49,41),THICK                                         703280
   41 GO TO (103,42,103,42,47,49,42,47,49,42,47,49),ISTTAB              703290
C                                                                       703300
C     SINGLE SHEET                                                      703310
C                                                                       703320
   42 TEMP1 = ETHET*HI                                                  703330
      TEMP2= TEMP1 * HI**2                                              703340
      XK11= TEMP1/TEMP3                                                 703350
      XD11= TEMP2/(12.0* TEMP3)                                         703360
      TEMP1 = EPHI*HI                                                   703370
      TEMP2= TEMP1*HI**2                                                703380
      XK22= TEMP1/TEMP3                                                 703390
      XD22= TEMP2/(12.0* TEMP3)                                         703400
      XK33 = XGPT*HI                                                    703410
      XD33= XK33*HI**2/12.0                                             703420
      YBARI = 0.0                                                       703430
      YBARC = 0.0                                                       703440
      YBARO = 0.0                                                       703450
      GO TO 55                                                          703460
C                                                                       703470
C     EQUAL SHEETS                                                      703480
C                                                                       703490
   47 CONTINUE                                                          703500
      XK11 = 2.0*ETHET*HI/TEMP3                                         703510
      XK22 = 2.0*EPHI*HI/TEMP3                                          703520
      XK33 = 2.0*XGPT                                                   703530
      ZBR = HI+T/2.0                                                    703540
      ZBH = (ZBR-HI/2.0)**2                                             703550
      XD33 = XGPT*HI*((HI**2)/6.0+2.0*ZBH)                              703560
      XD11 = HI*(XK11*HI/12.0+2.0*ETHET*ZBH/TEMP3)                      703570
      XD22 = HI*(XK22*HI/12.0+2.0*EPHI*ZBH/TEMP3)                       703580
      YBARI = ZBR-HI/2.0                                                703590
      YBARC = ZBR-HI-T/2.0                                              703600
      YBARO = HI/2.0-ZBR                                                703610
      GO TO 55                                                          703620
C                                                                       703630
C     UNEQUAL FACE SHEETS                                               703640
C                                                                       703650
   49 CONTINUE                                                          703660
      ZBR = (HI*HI+HO*HO+2.0*(HO*(HI+T)))/(2.0*(HI+HO))                 703670
```

```
FOR,IS PLINE,PLINE
      SUBROUTINE PLINE (X,Y,M,C,XINT,YINT,DYDX,D2YDX2)                  700010
C     SUBROUTINE FOR SPLINE FIT INTERPOLATION IN THE TABLE OF VALUES    700020
C     (X1,Y1) TO (XM,YM), WHERE M MAY BE AS LARGE AS 100, WHERE THE     700030
C     CONSTANTS C(1,K),C(2,K),C(3,K) AND C(4,K) ARE ALREADY COMPUTED    700040
C     AND STORED.                                                       700050
C     SUBROUTINE ALSO COMPUTES DY/DX AND D2Y/DX2 AT XINT.               700060
      DIMENSION X(14),Y(14),C(4,13)                                     700070
      IF (XINT-X(1)) 80,10,20                                           700080
   10 YINT = Y(1)                                                       700090
      K=1                                                               700100
      GO TO 70                                                          700110
   20 K = 1                                                             700120
   30 IF (XINT-X(K+1)) 60,40,50                                         700130
   40 YINT = Y(K+1)                                                     700140
      GO TO 70                                                          700150
   50 K = K + 1                                                         700160
      IF (M-K) 80,80,30                                                 700170
   60 YINT = (X(K+1) - XINT)*(C(1,K)*(X(K+1)-XINT)**2+C(3,K))           700180
      YINT = YINT + (XINT-X(K))*(C(2,K)*(XINT-X(K))**2+C(4,K))          700190
   70 DYDX=-3.0*(C(1,K)*(X(K+1)-XINT)**2-C(2,K)*(XINT-X(K))**2)         700200
     1      -C(3,K)+C(4,K)                                             700210
      D2YDX2=6.0*(C(1,K)*(X(K+1)-XINT)+C(2,K)*(XINT-X(K)))              700220
      RETURN                                                            700230
   80 WRITE (6,90)                                                      700240
   90 FORMAT (31H OUT OF RANGE FOR INTERPOLATION)                       700250
      RETURN                                                            700260
      END                                                               700270
```

```
FOR,IS PLICO,PLICO
      SUBROUTINE PLICO (X,Y,M,C)                                        800010
C     SUBROUTINE TO DETERMINE C(1,K),C(2,K),C(3,K) AND C(4,K).          800020
      DIMENSION X(14),Y(14),A(14,3),B(14),Z(14)                         800030
      DIMENSION D(13),P(13),E(13),C(4,13)                               800040
      MM = M-1                                                          800050
      DO 10 K=1,MM                                                      800060
      D(K) = X(K+1) - X(K)                                              800070
      P(K) = D(K)/6.0                                                   800080
   10 E(K) = (Y(K+1)-Y(K))/D(K)                                         800090
      DO 20 K=2,MM                                                      800100
   20 B(K) = E(K) - E(K-1)                                              800110
      A(1,2) = -1.0-D(1)/D(2)                                           800120
      A(1,3) = D(1)/D(2)                                                800130
      A(2,3) = P(2)-P(1)*A(1,3)                                         800140
      A(2,2) = 2.0*(P(1)+P(2)) - P(1)*A(1,2)                            800150
      A(2,3) = A(2,3)/A(2,2)                                            800160
      B(2) = B(2)/A(2,2)                                                800170
      DO 30 K=3,MM                                                      800180
      A(K,2) = 2.0*(P(K-1)+P(K))-P(K-1)*A(K-1,3)                        800190
      B(K) = B(K)-P(K-1)*B(K-1)                                         800200
      A(K,3) = P(K)/A(K,2)                                              800210
   30 B(K) = B(K)/A(K,2)                                                800220
      Q = D(M-2)/D(M-1)                                                 800230
      A(M,1) = 1.0+Q+A(M-2,3)                                           800240
      A(M,2) = -Q-A(M,1)*A(M-1,3)                                       800250
      B(M) = B(M-2)-A(M,1)*B(M-1)                                       800260
      Z(M) = B(M)/A(M,2)                                                800270
      MN = M-2                                                          800280
      DO 40 I=1,MN                                                      800290
      K = M-I                                                           800300
   40 Z(K) = B(K)-A(K,3)*Z(K+1)                                         800310
      Z(1) = -A(1,2)*Z(2)-A(1,3)*Z(3)                                   800320
      DO 50 K=1,MM                                                      800330
      Q = 1.0/(6.0*D(K))                                                800340
      C(1,K) = Z(K)*Q                                                   800350
      C(2,K) = Z(K+1)*Q                                                 800360
      C(3,K) = Y(K)/D(K)-Z(K)*P(K)                                      800370
   50 C(4,K) = Y(K+1)/D(K)-Z(K+1)*P(K)                                  800380
      RETURN                                                            800390
      END                                                               800400
```

```
FOR,IS SIMQ,SIMQ
      SUBROUTINE SIMQ (A,B)                                          900010
      DIMENSION A(1),B(1)                                            900020
C                                                                    900030
C     FORWARD SOLUTION                                               900040
C                                                                    900050
      N = 3                                                          900060
      TOL = 0.0                                                      900070
      KS = 0                                                         900080
      JJ = -N                                                        900090
      DO 65 J=1,N                                                    900100
      JY = J+1                                                       900110
      JJ = JJ+N+1                                                    900120
      BIGA = 0.0                                                     900130
      IT = JJ-J                                                      900140
      DO 30 I=J,N                                                    900150
C                                                                    900160
C     SEARCH FOR MAXIMUM COEFFICIENT IN COLUMN                       900170
C                                                                    900180
      IJ = IT+I                                                      900190
      IF (ABS(BIGA)-ABS(A(IJ))) 20,30,30                             900200
   20 BIGA = A(IJ)                                                   900210
      IMAX = I                                                       900220
   30 CONTINUE                                                       900230
C                                                                    900240
C     TEST FOR PIVOT LESS THAN TOLERANCE (SINGULAR MATRIX)           900250
C                                                                    900260
      IF (ABS(BIGA)-TOL) 35,35,40                                    900270
   35 KS = 1                                                         900280
      RETURN                                                         900290
C                                                                    900300
C     INTERCHANGE ROWS IF NECESSARY                                  900310
C                                                                    900320
   40 I1 = J+N*(J-2)                                                 900330
      IT = IMAX-J                                                    900340
      DO 50 K=J,N                                                    900350
      I1 = I1+N                                                      900360
      I2 = I1+IT                                                     900370
      SAVE = A(I1)                                                   900380
      A(I1) = A(I2)                                                  900390
      A(I2) = SAVE                                                   900400
C                                                                    900410
C     DIVIDE EQUATION BY LEADING COEFFICIENT                         900420
C                                                                    900430
   50 A(I1) = A(I1)/BIGA                                             900440
      SAVE = B(IMAX)                                                 900450
      B(IMAX) = B(J)                                                 900460
      B(J) = SAVE/BIGA                                               900470
C                                                                    900480
C     ELIMINATE NEXT VARIABLE                                        900490
C                                                                    900500
      IF (J-N) 55,70,55                                              900510
   55 IQS = N*(J-1)                                                  900520
      DO 65 IX=JY,N                                                  900530
      IXJ = IQS+IX                                                   900540
      IT = J-IX                                                      900550
      DO 60 JX=JY,N                                                  900560
      IXJX = N*(JX-1)+IX                                             900570
      JJX = IXJX+IT                                                  900580
   60 A(IXJX) = A(IXJX)-(A(IXJ)*A(JJX))                              900590
   65 B(IX) = B(IX)-(B(J)*A(IXJ))                                    900600
```

```
C                                                                       900610
C     BACK SOLUTION                                                     900620
C                                                                       900630
   70 NY = N-1                                                          900640
      IT = N*N                                                          900650
      DO 80 J=1,NY                                                      900660
      IA = IT-J                                                         900670
      IB = N-J                                                          900680
      IC = N                                                            900690
      DO 80 K=1,J                                                       900700
      B(IB) = B(IB)-A(IA)*B(IC)                                         900710
      IA = IA-N                                                         900720
   80 IC = IC-1                                                         900730
      RETURN                                                            900740
      END                                                               900750
```

```
FOR,IS CYCLE,CYCLE
      SUBROUTINE CYCLE
      INTEGER SEGTAB,TYPE
      COMMON NERROR,ICOUNT
      COMMON /TYGER/ XMAT(270,10),LST(30),ST(30,31),DUM(20),NSEGS(30),
     C               NRNG(30),JROW(30,30),KELVN(30,30),JMAT(30,30),
     0               NPP(30,30),NXMAT(20),NREG,NORING,NMPT
      COMMON /NAM1/ FACE(4),STRGO(7),THERM(4),MATER(3),SEGTAB(12)
      EQUIVALENCE (DUM(1),D)
      DATA DLIMTR/4H----/
      READ(5,1010) LINPUT,CYC1,CYCP,LDISTL,NMAT,OMEGA,DUM
 1010 FORMAT(7X,I2,2X,F6.0,F4.0,2X,2I2,31X,E14.7,T1,20A4)
      WRITE(6,2001) DUM
 2001 FORMAT(1X,20A4)
      IF (LDISTL.EQ.0) LDISTL = 1
      IF (NMAT.EQ.0) GO TO 1
      NROW = 0
      KK = -1
      NSAVE = 0
      DO 13 I=1,NMPT
      KK = KK+2
      II = NROW+1
      READ(5,1004) STD,TYPE,DUM
 1004 FORMAT(2(A4,6X),T1,20A4)
      WRITE(6,2001) DUM
      NROW = 27
      DO 11 L=1,3
   11 IF (TYPE.EQ.MATER(L)) GO TO 12
      NERROR = 1
      CALL ETRAP
      WRITE(6,223)
  223 FORMAT(28X,103H*   DUE TO INPUT ERROR IT IS IMPOSSIBLE TO CHECK TH  200830
     1E FOLLOWING CARDS UP TO THE DASH-SEPARATOR CARD.   */)               200840
      GO TO 2
   12 CONTINUE
      IF (L.EQ.1) NROW = 7
      IF (L.EQ.2) NROW = 17
      LLL = NSAVE+NROW
      READ(5,1005) ((XMAT(M,J),J=1,10),M=II,LLL)
 1005 FORMAT(5E14.7)
      WRITE(6,1205) ((XMAT(M,J),J=1,10),M=II,LLL)
 1205 FORMAT(1X,5E14.7)
      DO 608 M=3,10
      IF (XMAT(II,M-1).LT.XMAT(II,M)) GO TO 608
      IF (XMAT(II,M).EQ.0.0) GO TO 608
      NERROR = 32
      CALL ETRAP
  608 CONTINUE
      NROW = NSAVE+NROW
   13 NSAVE = NROW
    2 READ(5,2000) DUM
 2000 FORMAT(20A4)
      WRITE(6,2001) DUM
      IF (D.NE.DLIMTR) GO TO 2
      WRITE(6,222)
  222 FORMAT(/)
    1 CONTINUE
      IF (LDISTL.EQ.1) GO TO 150
      DO 100 JREG=1,NREG
      NSEG = NSEGS(JREG)
      DO 105 JSEG=1,NSEG
```

```
      NROW = JROW(JREG,JSEG)
      KELVIN = KELVN(JREG,JSEG)
      MAT = JMAT(JREG,JSEG)
      NP = NPP(JREG,JSEG)
      K = NROW+1
      JJ = 1
      JJJ = 6
      JT = JJ
      JTT = JJJ
      L = 0
      READ(5,1014) (LST(J),J=JJ,JJJ),DUM
 1014 FORMAT(6I1,T1,20A4)
      WRITE(6,2001) DUM
      IF (LST(JJ)) 8031,19,20
   20 L = LST(JJ)
 1026 IF (LST(1).NE.1.AND.(KELVIN.EQ.3.OR.KELVIN.EQ.4)) GO TO 1027
      GO TO 1028
 1027 NERROR = 35
      CALL ETRAP
      WRITE(6,999) NRC,NSC
  999 FORMAT(/5X,'*   REGION NUMBER ',I2,5X,'SEGMENT NUMBER ',I2,'   *'
     1       ///)
 1028 IF (LST(1).NE.4.AND.KELVIN.EQ.1) GO TO 1029
      GO TO 1025
 1029 NERROR = 35
      CALL ETRAP
      WRITE(6,999) NRC,NSC
 1025 IF (L.NE.1.AND.L.NE.4) GO TO 8031
      GO TO 19
 8031 NERROR = 27
      CALL ETRAP
      WRITE(6,999) NRC,NSC
      WRITE(6,223)
      GO TO 7
   19 JJ = JJ+1
      IF (L.NE.0.AND.KELVIN.EQ.2) GO TO 8075
      GO TO 23
 8075 NERROR = 35
      CALL ETRAP
      WRITE(6,999) NRC,NSC
   23 IF (LST(JJ)) 8032,22,21
   21 L = L+1
      IF (LST(JJ).NE.1) GO TO 8032
   22 IF (JJ.EQ.JJJ) GO TO 24
      JJ = JJ+1
      GO TO 23
 8032 NERROR = 27
      CALL ETRAP
      WRITE(6,999) NRC,NSC
      WRITE(6,223)
      GO TO 7
   24 IF (L.EQ.0) GO TO 71
      LY = K
      KK = K+L-1
      DO 72 M=K,KK
      READ(5,1005) (ST(M,J),J=1,NP)
      WRITE(6,1205) (ST(M,J),J=1,NP)
   72 CONTINUE
   71 CONTINUE
      IF (NMAT.EQ.0.OR.LDISTL.NE.1) GO TO 590
      WRITE(6,996)
```

```
996 FORMAT(/35X,'WARNING - CHECK PREVIOUS TEMPERATURE LOADS (IF ANY) A
   1GAINST NEW MATERIAL PROPERTY TABLE RANGE.'/)
    GO TO 105
590 CONTINUE
    IF (LST(1).EQ.0) GO TO 105
    IF (MAT.GT.NMPT) GO TO 7
    IF (NP.LT.2.OR.NP.GT.30) GO TO 7
    IF (KELVIN.NE.5) GO TO 125
    IF (LST(1).EQ.1) KELVIN = 3
    IF (LST(1).EQ.4) KELVIN = 1
125 CONTINUE
    DO 123 LL=1,NP
    L=(MAT-1)*2+1
    II=NXMAT(L)
     III=NXMAT(L+1)
    M=1
    GO TO (91,123,93,93),KELVIN
 91 TEMPAV = (ST(LY,LL)+ST(LY+1,LL)+ST(LY+2,LL)+ST(LY+3,LL))/4.0
    ARG=TEMPAV
    GOTO 94
 93 ARG = ST(NROW + 1,LL)
 94 DO 104 I = 2,10
    IF (ARG-XMAT(II,I)) 121,123,104
121 IF (I-2) 8007,8007,123
8007 NERROR = 28
    CALL ETRAP
    WRITE(6,998) NRC,NSC,LL
998 FORMAT(/5X,'*   REGION NUMBER ',I2,5X,'SEGMENT NUMBER ',I2,5X,      204760
   1       'SEGMENT GEOMETRY TABLE ITEM ',I2,'   *'///)
    GO TO 123
104 CONTINUE
    NERROR = 29
    CALL ETRAP
    WRITE(6,998) NRC,NSC,LL
123 CONTINUE
105 CONTINUE
    NRING = NRNG(JREG)
    IF (NRING.EQ.0) GO TO 100
    DO 110 K=1,NRING
    READ(5,215) SIGOX,RMOSS,RMOSN,TI,TO,DUM
215 FORMAT(5E14.7,T1,20A4)
110 WRITE(6,2001) DUM
100 CONTINUE
    IF (NORING.EQ.0) GO TO 250
    DO 240 J=1,NORING
    READ(5,215) SIGOX,RMOSS,RMOSN,TI,TO,DUM
240 WRITE(6,2001) DUM
250 CONTINUE
    READ(5,302) LINLOD,DUM
302 FORMAT(I4,T1,20A4)
    WRITE(6,2001) DUM
    IF (LINLOD.EQ.0) GO TO 7
    DO 304 N=1,LINLOD
    READ(5,305) JEXT1,XFL,DUM
305 FORMAT(5X,I5,E14.7,T1,20A4)
    WRITE(6,2001) DUM
304 CONTINUE
  7 READ(5,2000) DUM
    WRITE(6,2001) DUM
    IF (D.NE.DLIMTR) GO TO 7
    WRITE(6,222)
```

```
FOR,IS PLICO,PLICO
      SUBROUTINE PLICO (X,Y,M,C)                                        2500010
C     SUBROUTINE TO DETERMINE C(1,K),C(2,K),C(3,K) AND C(4,K).          2500020
      DIMENSION X(14),Y(14),A(14,3),B(14),Z(14)                         2500030
      DIMENSION D(13),P(13),E(13),C(4,13)                               2500040
      MM = M-1                                                          2500050
      DO 10 K=1,MM                                                      2500060
      D(K) = X(K+1) - X(K)                                              2500070
      P(K) = D(K)/6.0                                                   2500080
   10 E(K) = (Y(K+1)-Y(K))/D(K)                                         2500090
      DO 20 K=2,MM                                                      2500100
   20 B(K) = E(K) - E(K-1)                                              2500110
      A(1,2) = -1.0-D(1)/D(2)                                           2500120
      A(1,3) = D(1)/D(2)                                                2500130
      A(2,3) = P(2)-P(1)*A(1,3)                                         2500140
      A(2,2) = 2.0*(P(1)+P(2)) - P(1)*A(1,2)                            2500150
      A(2,3) = A(2,3)/A(2,2)                                            2500160
      B(2) = B(2)/A(2,2)                                                2500170
      DO 30 K=3,MM                                                      2500180
      A(K,2) = 2.0*(P(K-1)+P(K))-P(K-1)*A(K-1,3)                        2500190
      B(K) = B(K)-P(K-1)*B(K-1)                                         2500200
      A(K,3) = P(K)/A(K,2)                                              2500210
   30 B(K) = B(K)/A(K,2)                                                2500220
      Q = D(M-2)/D(M-1)                                                 2500230
      A(M,1) = 1.0+Q+A(M-2,3)                                           2500240
      A(M,2) = -Q-A(M,1)*A(M-1,3)                                       2500250
      B(M) = B(M-2)-A(M,1)*B(M-1)                                       2500260
      Z(M) = B(M)/A(M,2)                                                2500270
      MN = M-2                                                          2500280
      DO 40 I=1,MN                                                      2500290
      K = M-I                                                           2500300
   40 Z(K) = B(K)-A(K,3)*Z(K+1)                                         2500310
      Z(1) = -A(1,2)*Z(2)-A(1,3)*Z(3)                                   2500320
      DO 50 K=1,MM                                                      2500330
      Q = 1.0/(6.0*D(K))                                                2500340
      C(1,K) = Z(K)*Q                                                   2500350
      C(2,K) = Z(K+1)*Q                                                 2500360
      C(3,K) = Y(K)/D(K)-Z(K)*P(K)                                      2500370
   50 C(4,K) = Y(K+1)/D(K)-Z(K+1)*P(K)                                  2500380
      RETURN                                                            2500390
      END                                                               2500400
```

```
FOR,IS ETRAP,ETRAP
      SUBROUTINE ETRAP                                                  1000010
      COMMON NERROR,ICOUNT                                              1000020
      ICOUNT = ICOUNT+1                                                 1000030
      GO TO (1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,  1000040
     1   23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40),NERROR
    1 WRITE(6,101)                                                      1000060
  101 FORMAT(/  4X,'ONE OF THE MATERIAL PROPERTY TABLES CANNOT BE IDENTI 1000070
     1FIED AS ISOT, ORTH, OR STIF.'/)                                   1000080
      GO TO 99                                                          1000090
    2 WRITE(6,102)                                                      1000100
  102 FORMAT(/  4X,'THE TYPE OF GEOMETRY OF A SEGMENT CANNOT BE IDENTIFI 1000110
     1ED AS ONE HANDLED BY THE PROGRAM.'/)                              1000120
      GO TO 99                                                          1000130
    3 WRITE(6,103)                                                      1000140
  103 FORMAT(/  4X,'THE NUMBER OF POINTS IN THE ST TABLE MUST BE BETWEEN 1000150
     1 2 AND 30.'/)                                                     1000160
      GO TO 99                                                          1000170
    4 WRITE(6,104)                                                      1000180
  104 FORMAT(/  4X,'A MATERIAL PROPERTY TABLE NAME FOR A SEGMENT CANNOT  1000190
     1BE FOUND IN THE TABLE LIST.'/)                                    1000200
      GO TO 99                                                          1000210
    5 WRITE(6,105)                                                      1000220
  105 FORMAT(/  4X,'THE TYPE OF MATERIAL PROPERTY TABLE FOR A SEGMENT CA 1000230
     1NNOT BE IDENTIFIED AS ISOT, ORTH, OR STIF.'/)                     1000240
      GO TO 99                                                          1000250
    6 WRITE(6,106)                                                      1000260
  106 FORMAT(/  4X,'THE PROBLEM INPUT CAN ONLY BE THIC, RWAF, RWA1, RWA2 1000270
     1, RWA3, ST10, ST11, ST12, ST13, ISG1, ISG2, OR ISG3.'/)           1000280
      GO TO 99                                                          1000290
    7 WRITE(6,107)                                                      1000300
  107 FORMAT(/  4X,'THE WALL CONSTRUCTION OF A SEGMENT CANNOT BE IDENTIF 1000310
     1IED AS SING, EQUA, UNEQ, OR BLAN.'/)                              1000320
      GO TO 99                                                          1000330
    8 WRITE(6,108)                                                      1000340
  108 FORMAT(/  4X,'THE TYPE OF TEMPERATURE INPUT FOR A SEGMENT CANNOT B 1000350
     1E IDENTIFIED AS THST, NOTH, THCN, OR THIN.'/)                     1000360
      GO TO 99                                                          1000370
    9 WRITE(6,109)                                                      1000380
  109 FORMAT(/  4X,'THE WAFFLE GRID SPACING IS ZERO.'/)                 1000390
      GO TO 99                                                          1000400
   10 WRITE(6,110)                                                      1000410
  110 FORMAT(/  4X,'THE RING SPACING IS ZERO.'/)                        1000420
      GO TO 99                                                          1000430
   11 WRITE(6,111)                                                      1000440
  111 FORMAT(/  4X,'THE STRINGER SPACING IS ZERO.'/)                    1000450
      GO TO 99                                                          1000460
   12 WRITE(6,112)                                                      1000470
  112 FORMAT(/  4X,'THE OUTSIDE SHEET THICKNESS IS ZERO.'/)             1000480
      GO TO 99                                                          1000490
   13 WRITE(6,113)                                                      1000500
  113 FORMAT(/  4X,'THE CORE THICKNESS IS ZERO.'/)                      1000510
      GO TO 99                                                          1000520
   14 WRITE(6,114)                                                      1000530
  114 FORMAT(/  4X,'THE SHEET THICKNESS IS ZERO.'/)                     1000540
      GO TO 99                                                          1000550
   15 WRITE(6,115)                                                      1000560
  115 FORMAT(/  4X,'THE INSIDE SHEET THICKNESS IS ZERO.'/)              1000570
      GO TO 99                                                          1000580
   16 WRITE(6,116)                                                      1000590
  116 FORMAT(/  4X,'THE K11 STIFFNESS PARAMETER IS ZERO.'/)             1000600
```

```
      GO TO 99                                                          1000610
   17 WRITE(6,117)                                                      1000620
  117 FORMAT(/  4X,'THE K12 STIFFNESS PARAMETER IS ZERO.'/)             1000630
      GO TO 99                                                          1000640
   18 WRITE(6,118)                                                      1000650
  118 FORMAT(/  4X,'THE K21 STIFFNESS PARAMETER IS ZERO.'/)             1000660
      GO TO 99                                                          1000670
   19 WRITE(6,119)                                                      1000680
  119 FORMAT(/  4X,'THE K22 STIFFNESS PARAMETER IS ZERO.'/)             1000690
      GO TO 99                                                          1000700
   20 WRITE(6,120)                                                      1000710
  120 FORMAT(/  4X,'THE K33 STIFFNESS PARAMETER IS ZERO.'/)             1000720
      GO TO 99                                                          1000730
   21 WRITE(6,121)                                                      1000740
  121 FORMAT(/  4X,'THE D11 STIFFNESS PARAMETER IS ZERO.'/)             1000750
      GO TO 99                                                          1000760
   22 WRITE(6,122)                                                      1000770
  122 FORMAT(/  4X,'THE D12 STIFFNESS PARAMETER IS ZERO.'/)             1000780
      GO TO 99                                                          1000790
   23 WRITE(6,123)                                                      1000800
  123 FORMAT(/  4X,'THE D21 STIFFNESS PARAMETER IS ZERO.'/)             1000810
      GO TO 99                                                          1000820
   24 WRITE(6,124)                                                      1000830
  124 FORMAT(/  4X,'THE D22 STIFFNESS PARAMETER IS ZERO.'/)             1000840
      GO TO 99                                                          1000850
   25 WRITE(6,125)                                                      1000860
  125 FORMAT(/  4X,'THE D33 STIFFNESS PARAMETER IS ZERO.'/)             1000870
      GO TO 99                                                          1000880
   26 WRITE(6,126)                                                      1000890
  126 FORMAT(/  4X,'THE PROGRAM CANNOT RECOGNIZE THE HARDENING CLUE AS B
     1EING EITHER ISOT, KINE OR PERF.'/)
      GO TO 99                                                          1000920
   27 WRITE(6,127)                                                      1000930
  127 FORMAT(/  4X,'THE LOAD INDICATOR CLUES CAN ONLY BE ZERO, BLANK, ON 1000940
     1E, OR FOUR.'/)                                                    1000950
      GO TO 99                                                          1000960
   28 WRITE(6,128)                                                      1000970
  128 FORMAT(/  4X,'THE INTERPOLATED VALUE OF TEMPERATURE FOR USE IN THE 1000980
     1 MATERIAL PROPERTY TABLE IS LESS THAN THE SECOND TEMPERATURE VALUE 1000990
     2.'/)                                                              1001000
      GO TO 99                                                          1001010
   29 WRITE(6,129)                                                      1001020
  129 FORMAT(/  4X,'THE INTERPOLATED VALUE OF TEMPERATURE FOR USE IN THE 1001030
     1 MATERIAL PROPERTY TABLE IS GREATER THAN THE LAST VALUE OF TEMPERA 1001040
     2TURE.'/)                                                          1001050
      GO TO 99                                                          1001060
   30 WRITE(6,130)                                                      1001070
  130 FORMAT(/  4X,'FOR KINEMATIC LINKS BETWEEN SEGMENTS, THE DEPENDENT  1001080
     1JOINT NUMBER MUST BE GREATER THAN THE INDEPENDENT JOINT NUMBER.'/) 1001090
      GO TO 99                                                          1001100
   31 WRITE(6,131)                                                      1001110
  131 FORMAT(/  4X,'J-TH JOINTS ON SUCCESSIVE INTER-REGION KINEMATIC LIN 1001120
     1K CARDS MUST BE IN INCREASING ORDER.'/)                           1001130
      GO TO 99                                                          1001140
   32 WRITE(6,132)                                                      1001150
  132 FORMAT(/  4X,'TEMPERATURE VALUES (COLUMNS 2 THRU END) IN THE MATER 1001160
     1IAL PROPERTY TABLE MUST BE IN INCREASING ORDER.'/)                1001170
      GO TO 99                                                          1001180
   33 WRITE(6,133)                                                      1001190
  133 FORMAT(/  4X,'FOR AN ANNULAR PLATE NEAR THE AXIS OF REVOLUTION, TH 1001200
     1E END POINT LOCATIONS SHOULD BE IN A RATIO BETWEEN .01 AND 100.'/) 1001210
```

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      GO TO 99                                                          1001220
   34 WRITE(6,134)                                                      1001230
  134 FORMAT(/  4X,'DEGREES OF FREEDOM OF DEPENDENT (J) JOINT OF KINEMAT 1001240
     1IC LINKS MUST BE ''ZEROED OUT''.'/)                               1001250
      GO TO 99                                                          1001260
   35 WRITE(6,135)                                                      1001270
  135 FORMAT(/  4X,'TEMPERATURE AND LOAD CLUES ARE INCONSISTENT.'/)     1001280
      GO TO 99                                                          1001290
   36 WRITE(6,136)                                                      1001300
  136 FORMAT(/  4X,'THE COMBINATION OF AN ORTHOTROPIC MATERIAL AND THE I
     1SOTROPIC HARDENING RULE IS NOT PRESENTLY ALLOWED.'/)
      GO TO 99                                                          1001330
   37 WRITE(6,137)                                                      1001340
  137 FORMAT(/  4X,'THE NUMBER OF REGION RINGS EXCEEDS 28.'/)           1001350
      GO TO 99                                                          1001360
   38 WRITE(6,138)                                                      1001370
  138 FORMAT(/  4X,'THE NUMBER OF STRUCTURE RINGS EXCEEDS 28.'/)        1001380
      GO TO 99                                                          1001390
   39 WRITE(6,139)                                                      1001400
  139 FORMAT(/  4X,'THE NUMBER OF GEOMETRY INPUT POINTS EXCEEDS 14.'/)  1001410
      GO TO 99
   40 WRITE(6,140)
  140 FORMAT(/  4X,'PLASTICITY ANALYSIS FOR THE STIFFNESS CLUE WORDS RWA
     1F OR ST10 IS INVALID.'/)
   99 RETURN                                                            1001420
       END                                                              1001430
```

SECTION 2

REFERENCES

1. Svalbonas, V., and Levine, H., "Numerical Nonlinear Inelastic Analysis of Stiffened Shells of Revolution", Vol. I - Theory Manual, NASA CR-2559.

2. Svalbonas, V., and Ogilvie, P., "Numerical Analysis of Stiffened Shells of Revolution - Vol. VII", NASA CR-2273, September 1973.

3. Svalbonas, V., Levine, H., and Ogilvie, P., "Numerical Nonlinear Inelastic Analysis of Stiffened Shells of Revolution", - Vol III Engineers Program Manual, NASA CR-2559.

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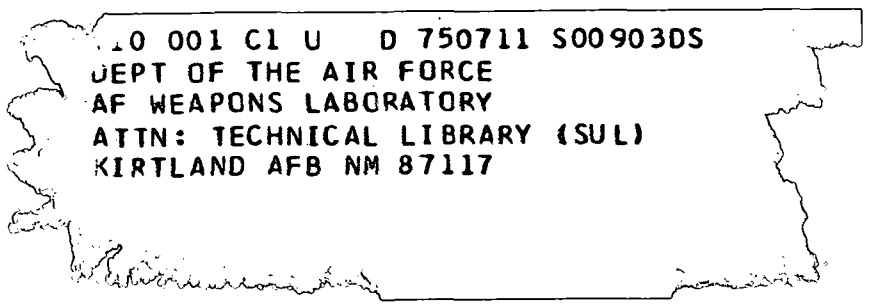

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